

ORDOVICIAN AND SILURIAN GRAPTOLITE FAUNA
OF THE SOUTHERN RICHARDSON MOUNTAINS
AND ADJACENT AREAS, YUKON TERRITORY

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A. C. LENZ

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FRONTISPIECE



Ordovician slates, Lower Canyon
of the Peel River , Yukon

UNIVERSITY OF ALBERTA
SCHOOL OF GRADUATE STUDIES

The undersigned hereby certify that they have
read and recommend to the School of Graduate Studies for
acceptance, a thesis entitled ORDOVICIAN and SILURIAN
GRAPTOLITIC FAUNA OF THE SOUTHERN RICHARDSON MOUNTAINS
AND ADJACENT AREAS, YUKON TERRITORY,
submitted by Alfred Carl Lenz
in partial fulfilment of the requirements for the
degree of Master of Science

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Date

April 18, 1911

Abstract

The Ordovician and Silurian rocks in the region of the southern Richardson Mountains and adjacent areas in northern Yukon Territory contain an abundant and varied graptolite assemblage. A complete section of rocks, ranging in age from lowermost Ordovician to uppermost Middle Silurian is apparently represented in the area. One hundred species, and one new genus, are described and figured from the two systems. These include two new variations and four new species from the Ordovician, and three new variations and one new species from the Silurian. The Lower Ordovician has by far the most abundant fauna.

Graptolite faunas are readily correlated with zones of the type sections of North America and Great Britain. Correlation and distribution of the graptolites are shown on accompanying tables.

THESIS
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THE UNIVERSITY OF ALBERTA

ORDOVICIAN AND SILURIAN GRAPTOLITE FAUNA
OF THE SOUTHERN RICHARDSON MOUNTAINS
AND ADJACENT AREAS, YUKON TERRITORY.

A DISSERTATION
SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE
OF MASTER OF SCIENCE

FACULTY OF ARTS AND SCIENCE
DEPARTMENT OF GEOLOGY

BY

Alfred Carl Lenz

EDMONTON, ALBERTA.

ACKNOWLEDGEMENTS

The writer acknowledges help rendered him by the members of the Geology Department throughout his undergraduate years. Special thanks are due; to Dr.C.R.Stelck who aroused the author's interest in palaeontology and who read parts of the manuscript, to Dr.P.S.Warren for the loan of valuable books, to Dr.R.E.Folinsbee for aid in setting up, and instruction in the use of the photographic equipment, and to Dr.S.J.Nelson, who was the writer's thesis supervisor and who offered much help and many constructive criticisms throughout the year.

The author is particularly indebted to The California Standard Company, whose graptolite collection was used for the thesis study. To Walter Koop, Richard Scarth, Ralph Vencour and Herb Oxley, the writer gratefully acknowledges help received throughout the year. Financial assistance was rendered the writer by The California Standard Graduate Fellowship.

Dr.L.M.Cumming of the Geological Survey of Canada gave valuable information regarding techniques of photographing and illustration of the graptolites.

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CHAPTER I

INTRODUCTION

General Statement

Little previous geological exploration has been carried out in and around the region of the Richardson Mountains, Yukon. Few oil companies have explored it, and what information there is, is not available for publication.

In the spring of 1955, The California Standard Company sent to the Northwest Territories and Northern Yukon a reconnaissance type exploration party, whose purpose it was to study the stratigraphy of the area. The writer was privileged to be present on this party and from the suite of graptolites collected was able to make a thesis study.

This thesis is concerned primarily with identification of the graptolitic fauna of the Ordovician and Silurian in the southern Richardsons and adjacent areas. The fauna is correlated with type and well known sections of North America and Great Britain.

At the request of The California Standard Company a detailed description of the stratigraphy, and the establishment of the relationship between the graptolitic shales in the area and the carbonate facies to the east is not given. Instead, only a brief discussion of the general stratigraphy is given.

Location and extent of the area

The area from which the graptolite faunas have been collected lies between $65^{\circ}30'$ and $66^{\circ}30'$ north latitude and between $134^{\circ}30'$ and $137^{\circ}00'$ west longitude, and represents roughly an area some fifty-five miles wide and eighty-four miles long. The eastern edge of the area lies about two hundred miles west-northwest of Norman Wells, Northwest Territories.

The main topographic^c feature is the Richardson Mountains, which in the southern portion form a long, narrow chain, trending approximately north-south.

The Richardsons are bordered to the east by the Peel Plateau; to the south by the Wind and Bonnet Plume basins and Trevor mountains; and to the west by the Eagle and Porcupine Plains. The main river of the area is the Peel river which cuts across the southern end of the Richardsons. Three other large rivers, the Hart, Wind and Bonnet Plume drain in the Peel.

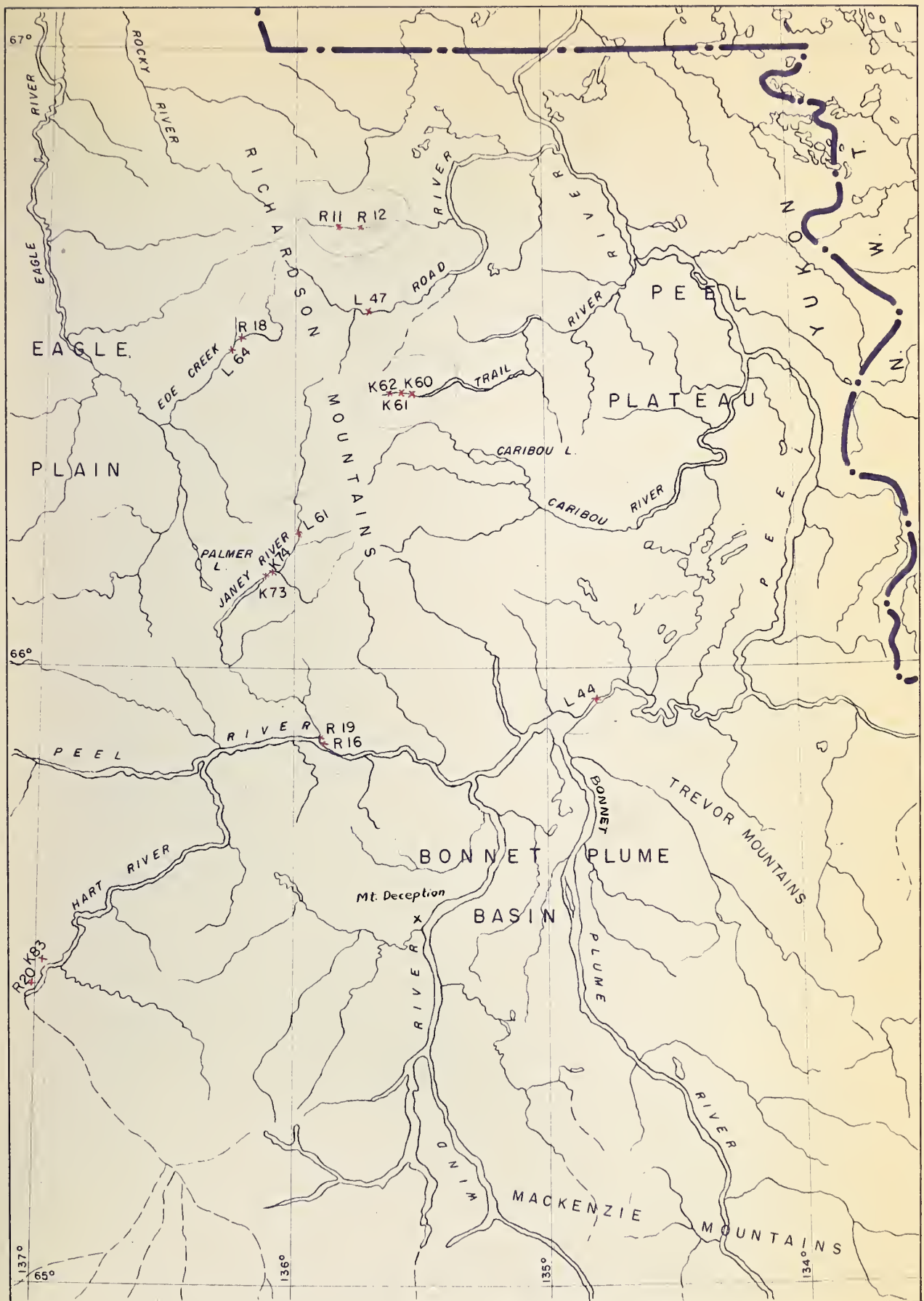
The location of the area, showing its extent, main topographic features, and fossil localities is shown on page 2a

Field Work

Surface mapping in this area was carried out during the summer field season of 1955 under the auspices of The California Standard Company, Calgary, Alberta. The geological party consisted of Walter Koop, Party Chief, Richard Scarth, Robert Gair, Douglas Rogan, Ralph Herron and the author. Work was done in and around the Richardson Mountains using Caribou Lake and Palmer Lake, on the east and west side of the Richardsons, respectively, as base camps.

Most of the transportation was by means of a Bell helicopter which proved very efficient, permitting much ground to be covered in a minimum length of time.

Because of the excellent exposures in deeply incised streams flowing from the east and west of the Richardsons, and because of the poor exposures on the mountains, nearly all sections were studied along river beds. From these sections the graptolite collections



MAP SHOWING FOSSIL LOCALITIES IN THE SOUTHERN
RICHARDSON MOUNTAINS AND ADJACENT AREAS

1 INCH = 15 78 MILES

were made. One boat trip, using an airforce type rubber dinghy was made down the Peel River from its junction with the Bonnet Plume, to the end of the Lower Canyon. This type of boat proved very satisfactory, though cumbersome to handle. Both Ordovician and Silurian were found to be excellently exposed here.

Sections were measured with the use of a one hundred foot tape, and Brunton compass.

Physiography and Structure

The part of the Richardson Mountains withⁱⁿ the area forms a straight nearly north-south trending chain, lying between the Peel Plateau to the east, the Bonnet Plume Basin to the south and the Eagle Plains to the west. They are low mountains, seldom exceeding 4000 feet, and are relatively narrow ranges, about twelve miles wide. The interior of the mountains is quite rugged and shows little evidence of glaciation. In general the structure of the Richardsons is a single broad anticlinorium with flat to nearly flat lying beds in the centre of the range, and steeply dipping to almost vertical beds on the flanks. Outcrops on the mountains are very poor, and the slopes are talus and moss covered. Leading out from the mountains, however, are numerous deeply incised streams, many of which contain excellent outcrops.

The Peel Plateau is a large triangular area which stands well above the MacKenzie Plain and occupies the angle between the north front of the MacKenzie Mountains and the east front of the Richardson Mountains. From heights of land, the evenness of the surface is very striking. Much of the original surface has been removed by later stream action, leaving the present three main terrace-like levels of erosion. In the south and south-eastern

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parts of the Plateau, numerous isolated hills arise to break the evenness of the surface. Except where near the mountain front, the beds underlying the plain are essentially flat or gently undulating.

The Bonnet Plume Basin is a somewhat rectangular area, immediately south of the Richardson Mountains, through which the much braided and mature Bonnet Plume and Wind Rivers drain into the Peel River. It is a broad basin like area, generally with very low relief and a monotonously level surface, broken in a few places by low hills, and isolated mountains such as Mount Deception.

The Eagle Plain, which is part of the Porcupine Plain, is a long shallow basin-like depression immediately west of the Richardson Mountains. It is sixty-miles wide, east and west, and 120 miles long, and is a low plateau-like area some 200-400 feet above the Eagle River, the main drainage system of the area. The rocks underlying the plain dip gently toward the centre of the basin and develop cuestas along the rim.

The plain shows little evidence of glaciation, but there is a considerable cover of river gravels along stream banks, and numerous misfit streams are evident, indicating a large volume of post-glacial runoff.

Previous Work and Exploration

The first written account of the area was by McConnell, who in 1888 ascended the Peel River as far as Fort McPherson, then ascended the Rat River to the headwaters and portaged over the watershed of the Richardsons Mountains, to descend the Bell River. He (1890) only briefly mentioned the rock types of the area and made little attempt to assign ages to them. At that time, he

believed that the Richardsons were merely an extension of the Rocky Mountains, instead of being a separate mountain system.

The first important work in the area with which the writer is concerned was by Camsell, who in the spring of 1905 started from Dawson City, ascended the Stewart River, crossed Braine Pass, and descended by way of Nash Creek and Wind River to Peel River. Camsell (1906) recorded the geology of both the Upper and Lower Canyons of the Peel as a series of steeply dipping slates with some limestone beds. He stated that these rocks between the two canyons were not exposed and were overlain by a broad, shallow Tertiary basin. No attempt was made to differentiate the slates, and no fossils were found in either canyon.

In 1943, Stelck, carrying out Canol Project investigations for Imperial Oil Company, Limited, descended the Wind and Peel Rivers by canoe. He (1944) recorded the lowest rocks of the area as a series of argillites, slates and schists about 7000 feet thick. No fossils other than sponge spicules were found in these and a tentative age of Cambrian and / or Ordovician was assigned to them. Overlying the slate argillite sequence, he found 1500 feet of Ordovician graptolitic slates and argillites which were correlated with the graptolitic shales of the Keele (Gravel) River. Silurian rocks were found to be represented by 2584 feet of shales, argillites and limestones, and to be separated from the Ordovician by a 50 foot bed of brecciated limestone which was included in the Silurian. He correlated the Silurian part of the section with the Silurian shales of the South Nahanni River, Northwest Territories.

Identification of the graptolites collected from the Canol study of the Peel River was published by Decker, Warren and Stelck in 1947, and disclosed the presence of Lower and Upper Ordovician, and Silurian rocks.

CHAPTER 2

Stratigraphy and Correlation

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Summary Statement

The Ordovician of the area is well represented, and contains an abundant and varied graptolite assemblage, which is readily correlated with type sections of the Appalachians. A complete section ranging from lowermost to uppermost Ordovician appears to be present in the area. The Lower Ordovician is particularly well represented and is divided into zones. The dominant fauna is the uppermost Lower Ordovician, namely the Diplograptus dentatus zone of the Deepkill. Only one specimen of this species was found. The same horizon, however, is marked almost everywhere in the area by the presence of the abundant and easily recognizable Cryptograptus antennarius. Other Lower Ordovician zones are generally delineated by faunal assemblages rather than individual species. Middle and Upper Ordovician faunas are sparsely represented, although enough species are present to clearly indicate the presence of the two. Dicranograptus sp., cf. D. spinifer, and Climacograptus bicornis are diagnostic for the Middle Ordovician; as are Climacograptus brevis and Climacograptus tridentatus var. Maximus for the Upper Ordovician.

It is worthy of note that along the Peel River and tributaries, Stelck (1944) found no Middle Ordovician, but he did find a more abundant Upper Ordovician fauna than is described by the writer. It is the writers' contention that a complete stratigraphic^c section is present. More detailed collections and a study of still more sections will probably reveal a complete faunal succession.

The Silurian strata range in age from upper Lower Silurian to upper Middle Silurian, the former being marked by Monograptus convolutus, and the latter by M. nilssoni. Although no individual section contained a complete sequence, a composite section indicates that an entire Silurian succession, from lowermost Silurian to uppermost Middle Silurian is apparently present in the area.

General Stratigraphy and Description of Localities

The lowest rocks of the area are a very thick series of argillites and slates. These apparently form the core of the Richardson Mountains and attain a tremendous thickness, in the order of 10,000 feet or more. Along the Peel River, Stelck(1944) reported 7,000 feet of these rocks which he tentatively identified as Cambrian and/or Ordovician. These have so far yielded only fossil sponge spicules, which are very abundant in some horizons. On the Trail River, forty miles north of the Peel, beds which apparently overlie this sequence contain the very lowermost Ordovician (Tremadoc) fauna, Dictyonema flabelliforme. Because of this fauna, the slate-argillite sequence is considered to be Cambrian.

Conformably and gradationally overlying the slate-argillite sequence is a thick series of Ordovician and Silurian shales and argillites with interbeds of calcareous shale and argillaceous limestone, the last being more massive than the other types of rocks. Within the black shales is the sometimes prolific graptolite fauna of the area. In these horizons, graptolites occur to the exclusion of all other forms of life except for a few phyllocarid crustaceans. The argillaceous limestone beds sometimes contain abundant shelly fossils such as corals, brachiopods (particularly Lingula sp.), stromatoporoids, crinoid discs, and an occasional trilobite. Pyrite is common in all shales and calcareous shales. Graded beds on a microscale are common within the argillites. On the whole, shales and argillites are well bedded and show little evidence of shallow water deposition such as ripple marks, etc. It is therefore thought that the graptolites lived in a geosynclinal environment. Graptolites are generally well preserved within fissile shales, but are very poorly preserved in, or absent from most argillites, indicating that metamorphism has

destroyed many or most of the graptolites.

In most cases the boundary between the Ordovician and Silurian is gradational and is based primarily on faunal evidence. In general, however, the carbonate content of Silurian rocks is greater than in the Ordovician. This would permit the establishment of ^{an}arbitrary boundary based on lithology.

In the Lower Canyon of the Peel River, this boundary is very marked, as the Ordovician beds are separated from Silurian rocks by a fifty foot bed of massive brecciated dolomite. The base of the dolomite is considered the base of the Silurian (Stelck, 1944). The two systems here have a thickness of about 4,000 feet, of which 1500 feet is Ordovician (Stelck, 1944).

The Ordovician of the Lower Canyon of the Peel River contains a prolific graptolite fauna. The age ranges from Tremadoc (lowermost Ordovician) to Middle and probably Upper Ordovician. The presence of the last, is not definitely established. Farther upstream, near the mouths of the Wind and Bonnet Plume Rivers, Upper Ordovician graptolites were found by Stelck⁽¹⁹⁴³⁾; and it is highly probable that they occur in the Lower Canyon as well.

The Silurian of the Lower Canyon contains abundant graptolites in the basal part of the section. On the basis of Monograptus convolutus, these lower beds are correlated with the Upper Llandovery (upper Lower Silurian) of Great Britain.

The Upper Canyon of the Peel, thirty miles upstream from the Lower Canyon, contain a thick section of Ordovician and Silurian rocks. The former ranges in age from lowermost Ordovician to Middle Ordovician. Underlying the Tremadoc beds are rocks of uppermost Lower Ordovician. This would suggest a fault; probably an overthrust

of considerable magnitude. The Ordovician beds are overlain by Middle Silurian Shales. The latter contain Monograptus spiralis (?) and Retiolites perlatus var. daironi and are correlated with the Clinton shales of New York.

About 15 miles south of the Peel River, on Mount Deception, Silurian shales are apparently overlain by massive dolomite of Silurian (?) age (Stelck, 1944).

Along the Hart River some twenty miles south of the Peel, the Ordovician is apparently represented by only a carbonate facies. These carbonates are overlain by very fissile black shales of Middle Silurian age, which are correlated with the Lower Ludlow (Lockport equivalent ?) of Great Britain, on the basis of Monograptus nilssoni. This fauna represents the highest Silurian graptolite zone found in the area.

No graptolites are found on the Caribou River, twenty-five miles north of the Peel River, as the preexisting shales have been dynamically metamorphosed to chlorite schist.

Forty miles north of the Peel, on the Trail River, Ordovician and Silurian rocks are represented by shales and argillites with interbeds of argillaceous limestone. Only Lower Ordovician dendroid graptolites such as Callograptus salteri are present. These rocks are overlain by upper Lower Silurian rocks of Llandovery age as shown by the presence of Monograptus communis var. A.

The Road River section, about fifteen miles north of the Trail River, has a similar lithology to that of the Trail River; a thicker section, however, is present. Graptolites are restricted to only a few zones. The remainder of the rocks are barren, as fossils apparently were destroyed by lithification and diagenesis. The Ordovician is represented by only upper Deepkill type fauna as shown by Cryptograptus antennarius, while Silurian is

correlated with the Clinton shales.

On the tributary of the Road River, Ordovician ranges from lowermost Ordovician to lower Middle Ordovician. The latter age is indicated by Dicranograptus sp.cf.D.spinifer, a typical Normanskill form. Silurian on this tributary is represented by a single specimen of Rastrites hybridus which is of upper Llandovery age.

Along "Ede" Creek^I an extremely thick section of Cambrian(?), Ordovician and Silurian is encountered. Graptolite faunas are few and far between. They are nearly absent from silicified shales zones, indicating that silicification has destroyed most graptolites. There is, however, sufficient faunal evidence to indicate that the entire Ordovician sequence is present. The Ordovician is overlain abruptly but apparently conformably by Silurian shales, silicified shales and some calcareous shales. The first type of shale contains sufficient graptolites to indicate the presence of Clinton and probably higher beds.

A very thick sequence of Ordovician and Silurian is encountered on "J aney River"^I about twenty miles south of "Ede" creek. The entire Ordovician is apparently present, and is overlain conformably by Lower Silurian. The presence of the latter is shown by Monograptus convolutus which is an upper Llandovery species.

Invariably and disconformably overlying the Silurian shale sequences are a thick series of distinctive, easily recognizable black, platy to flaggy, sulfurous, ferruginous shales. On the Lower Canyon of the Peel, the shales are fairly soft and fissile and are considered Fort Creek (Upper Devonian) equivalents by Stelck (1944). In all other sections north of the Peel, the shales are totally silicified, form steep walls and contain no fossils. They are considered correlative with the Fort Creek of the MacKenzie River

^I Field names for two unnamed creeks on flanks of Richardson Mountains.

area on the basis of their lithologic similarity.

The siliceous shales are in turn disconformably overlain by a very thick succession of siltstones, sandstones, shales and conglomerates, which contain few or no fossils and are of unknown age, but are post Fort Creek and pre-Lower Cretaceous. This series shows considerable variation on both its upper and lower boundaries. In the Peel Plateau area, these rocks are overlain by Lower Cretaceous sandstones and shales with ironstone concretions. It is therefore, apparent that a very thick stratigraphic succession is represented in the area.

Correlations of the Ordovician with graptolite zones of the type sections of the Appalachian region, and of the Silurian with the type sections of Great Britain are shown in Tables I and II, respectively.

It is to be emphasized that accurate zonal correlation is not possible in all cases as certain species show a long range rather than being confined to one zone. Where accurate zoning is not possible, the fauna is placed in a zone midway between the lowest and highest occurrence of that species. The zoning used by the writer for the Ordovician is taken from Ruedemann (1947,p.52). It is realized that many boundary problems exist within the North American Ordovician and that more recent literature would refute certain of these zones. On the whole, however, this zonation appears quite sound and is accepted as such by the writer. The Lower-Middle Silurian boundary in Britain is still under dispute. The writer will follow the interpretation given by Moore (1949) and will assume it occurs between the Llandovery and Gala formations.

An approximate correlation between various North American and British Ordovician and Silurian type sections, as well as other formations referred to in faunal descriptions, is given in Table III.

Explanation of Correlation Tables

Correlation of Ordovician and Silurian faunas of the area are shown on the accompanying tables. Table One^{is} for the Ordovician, and Table Two for the Silurian.

Ordovician faunas are correlated with graptolite zones of North America as proposed by Ruedemann (1947). Formations given are the graptolite bearing type sections of the Appalachian region. Graptolite zones shown are the zones into which these formations have been divided.

Similarly, Silurian graptolites of the area are correlated with the graptolite zones (after Elles and Wood, 1901-1918) of the type formations of Great Britain.

Locality letters and numbers, and footages marked above faunal assemblages within the table are those actually used in the field. For example, at locality L44, Anisograptus richardsoni was collected in a horizon 150 feet above the zero point or "base" of the outcrop section. Likewise, at 800 feet in the same locality Isograptus caduceus, etc., was collected, 800 feet above the base of this same outcrop. In each case, the zero point or "base" was the lowest (or highest) exposure of a section, and the point from which measurements were begun. Most localities were measured going up in section, and therefore footages increase upwards. A few, however, for example Locality L64, were measured downward from the stratigraphically highest exposure of the section, so that numbers increase in descending order. Locality R16, in the Upper Canyon of the Peel River is worthy of special note. Measurement here was made going up in section. The lowest fossil horizon at 3740 feet, however, contains uppermost Lower Ordovician graptolites, whereas the overlying fossil horizon at 3790 feet, contains a lowermost Ordovician fauna. The faunas thereafter occur in normal ascending succession. A fault is therefore inferred between

3740 feet and 3790 feet, and the fauna from 3740 feet is placed in its proper graptolite zone, the Diplograptus dentatus zone which is thought to overlies the fossil horizon at 4520 feet.

Where exact zonation of a faunal assemblage is in doubt a question mark is placed behind the horizon footage.

| EPOCH | FORMATION | ZONE NUMBER | GRAPTOLITE ZONES OF APPALACHIAN REGION | LOCALITY L 4 4 LOWER CANYON OF PEEL RIVER | LOCALITY L 4 7 ROAD RIVER | LOCALITY L 6 1 "JANEY" RIVER | LOCALITY L 6 4 "EDE" CREEK | LOCALITY R 1 1 TRIBUTARY TO ROAD RIVER | LOCALITY R 1 2 TRIBUTARY TO ROAD RIVER |
|--------|------------|---------------|---|--|---|--|---|--|---|
| UPPER | ORDOVICIAN | ATWATER | 20 | Glossograptus quadrimucronatus typus | | | | | |
| | | DEER RIVER | 19 | Climacograptus typicalis pasterus | | | | | |
| | | U T I C A | 18 | Climacograptus pygmaeus | | | | | |
| | | | 17 | Dicranograptus nichalsani | | | 5150' Diplograptus truncatus var. intermedius Climacograptus. brevis C. cf. latus | | |
| | | | 16 | Climacograptus typicalis | | | | | |
| MIDDLE | ORDOVICIAN | CANAJOHARIE | 15 | Climacograptus spiniferus | | | | | |
| | | | 14 | Lasiograptus eucharis | | | | | |
| | | | 13 | Glossograptus quadrimucronatus cornutus | | | | | |
| | | | 12 | Diplograptus amplexicaulis | | | | | |
| | | | 11 | Mesograptus mahawkensis | | | | | |
| | | MAGOG | 10 | Cryptograptus tricornis insectiformis | | | | | |
| | | NORMANSKILL | 9 | Corynaides gracilis | | | | | |
| | | | 8 | Nemagraptus gracilis | | | 6045' Dicranograptus cf. spinifer | | 2' Diplograptus cf. teretiusculus var. siccatus |
| | | | 7 | Diplograptus dentatus | 800' Isograptus caduceus Didymograptus euodus Laganograptus logani Loganograptus logani var. pertenuis Triganograptus ensiformis Lasiograptus echinatus | 930-1030' Cryptagraptus antennarius Glossograptus ciliatus var. A Didymograptus cuspidatus Isograptus farcipiformis Tetragraptus kindlei Genus novum cf. Isograptus | 6165' Phyllograptus anna mut ultimus Lasiograptus cf. echinatus Cryptagraptus antennarius | 1150' Cryptograptus antennarius Isograptus caduceus mut. nanus I. caduceus var. A T pendens L. logani var. pertenuis Phyllograptus cf. angustifolius P anna mut ultimus | 30' Genus novum cf. Isograptus 75' Cryptograptus antennarius Diplograptus cf. perexcavatus Phyllograptus angustifolius P anna mut ultimus Glossograptus horridus? T pendens |
| | | | | | 600' | | | | |

| LOCALITY R 1 2 TRIBUTARY TO ROAD RIVER | LOCALITY R 1 6 UPPER CANYON OF PEEL RIVER | LOCALITY R 1 9 UPPER CANYON OF PEEL RIVER | LOCALITY K 6 1 TRAIL RIVER | LOCALITY K 6 2 B TRAIL RIVER | LOCALITY K 7 3 "JANEY" RIVER |
|--|---|--|----------------------------------|------------------------------------|--|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | 2080' ? Climacograptus tridentatus var maximus |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | 275' Climacograptus bicornis Diplograptus vespertinus? | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| 2' Diplograptus cf. teretiusculus var. siccatus | | | | | |
| 30' Genus novum cf. Isograptus 75' Cryptograptus antennarius Diplograptus cf. perexcavatus Phyllograptus angustifolius P. anna mut. ultimus Glassograptus harridus? T. pendens | 3740' Cryptagraptus antennarius Diplograptus dentatus? Isograptus cf. caduceus mut. nanus Climacograptus n.sp. A | 10' Didymograptus extenuatus Phyllagraptus anna mut. ultimus | | | 1480-1560' Isograptus caduceus var. A D. cf. extensus Climacograptus n.sp. A Acanthagraptus sp. |
| | ? — ? — ? 4520' | | | | |

| | | | | | | | | | |
|------------|-------------------------|--------------|--------------------------|---|---|---|---|---|--|
| MIDDLE | NORMANSKILL | 9 | Corynoides gracilis | | | | | | |
| | | 8 | Nemagraptus gracilis | | | | 6045' Dicranograptus cf. spinifer | | 2' Diplograptus cf. teretiusculus var. siccatus |
| ORDOVICIAN | D. E. E. P. K. I. L. L. | 7 | Diplograptus dentatus | 800' Isograptus caduceus Didymograptus euadus Loganograptus logani Loganograptus logani var. pertenuis Trigonograptus ensiformis Lasiagraptus echinatus | 930-1030' Cryptograptus antennarius Glossograptus ciliatus var. A Didymograptus cuspidatus Isograptus forcipiformis Tetragraptus kindlei Genus novum cf. Isograptus | | 6165' Phyllograptus anna mut. ultimus Lasiograptus cf. echinatus Cryptograptus antennarius | 1150' Cryptograptus antennarius Isograptus caduceus mut. nanus I. caduceus var. A T. pendens L. lagani var. pertenuis Phyllograptus cf. angustifolius P. anna mut. ultimus | 30' Genus novum cf. Isograptus 75' Cryptograptus antennarius Diplograptus cf. perexcavatus Phyllograptus angustifolius P. anna mut. ultimus Glossagraptus horridus? T. pendens |
| | | 6 | Didymograptus bifidus | 600' Tetragraptus approximatus T. pendens, T. putillus T. lavalensis T. quadribrachiatus Didymograptus cf. extensus D. nicholsoni Phyllograptus anna mut. longus Dichograptus maccoyi D.n.sp. A, Clonograptus sp. | D. cf. extensus D. cf. nicholsoni | | | | |
| | | 5 | Didymograptus | 500'-525' Tetragraptus quadribrachiatus D. extensus | | | LOCALITY R18 - 8910' ? "EDE" CREEK T. quadribrachiatus | | |
| | | 4 | Phyllograptus typus | 480-500' ? Clonograptus flexilis D. cf. extensus Dictyonema robustum Dichograptus n.sp. A | | 1615' Dendrograptus cf. flexuosus 370' Callograptus salteri Dendrograptus flexuosus | | | |
| | | 3 | Clonograptus flexilis | 440' T. approximatus Bryograptus lapworthi, B. cf. pusillus Dichograptus maccoyi, D. n.sp. A Cl. cf. flexilis T. quadribrachiatus Dictyonema quadrangulare 400' ? Temnograptus ramulus Dichograptus n.sp. B 300' T. quadribrachiatus | | | | | |
| | | SCHAGHTICOKE | 2 | Staurograptus dichotomous | 150' Staurograptus dichotomous var. apertus Anisograptus richardsoni | | | | |
| | 1 | | Dictyonema flabelliforme | | | | | | |

TABLE ONE - CORRELATION OF ORDOVICIAN GRAPTOLITE FAUNA OF THE AREA

| | | | | | |
|---|--|--|--|--|---------------|
| | 2 Diplograptus cf. teretiusculus var. siccatus | | | | |
| antennarius uceus t. nanus var. A pertenuis cf gustifolius ultimus | 30' Genus novum cf. Isograptus 75' Cryptograptus antennarius Diplograptus cf. perexcavatus Phyllograptus angustifolius P. anna mut. ultimus Glossograptus horridus? T. pendens | 3740' Cryptograptus antennarius Diplograptus dentatus? Isograptus cf. caduceus mut. nanus Climacograptus n.sp. A ? — ? — ? — | 10' Didymograptus extenuatus Phyllograptus anna mut. ultimus | | |
| | | 4520' Tetragraptus lavalensis T. scandens var. curvatus | | | |
| | | 4400' T. lavalensis Didymograptus nitidus? | | | |
| | | 4303' Dictyonema murrayi T. quadribrachiatus | | Callograptus salteri Dendrograptus aff. fruticosus | 960 Callag |
| | | | | | |
| | | | | | |
| | | | | | |

| EPOCH | FORMATION | ZONE NO | GRAPTOLITE ZONES OF GREAT BRITAIN | LOCALITY R12 ROAD RIVER TRIBUTARY | LOCALITY R19 UPPER CANYON OF PEEL RIVER | LOCALITY R20 HART RIVER | LOCALITY L44 LOWER CANYON OF PEEL RIVER | LOCALITY L47 ROAD RIVER | LOCALITY L64 "EDE" CREEK | LOCALITY K60 TRAIL RIVER | LOCALITY K74 "JANEY" RIVER | |
|-----------------------------|--------------|---------------------------|---|--|--|---|--|--|---|--------------------------------|---|---|
| M I D D L E S I L U R I A N | LOWER LUDLOW | 21 | Monograptus lentwardinensis | | | | | | | | | |
| | | 20 | M. tumescens | | | | | | | | | |
| | | 19 | M. scanicus | | | | | | | | | |
| | | 18 | M. nilssani | | | 119' ? M. cf. gatlandicus M. cf. ultimus 221' M. nilssani Linagraptus phillipsi var. multiramosus | | | | | | |
| | | 17 | M. vulgatus | | | | | | | | | |
| | WENLOCK | 16 | Cyrtagraptus lundgreni | | | | | | | | | |
| | | 15 | C. rigidus | | | | | | | | | |
| | | 14 | C. linnarssani | | | | | | 2460' ? M. vamerinus M. n sp A | | | |
| | | 13 | C. symmetricus | | | | | | | | | |
| | | 12 | M. riccartanensis | | | | | 2350' M. riccartanensis M. vamerinus ? | | | | |
| | GALIA | 11 | C. purchisani | | | | | | | | | |
| | | 10 | M. crenulatus | | | | | | | | | |
| | | 9 | M. griestanensis | | | | | | | | | |
| | | 8 | M. crispus | | | | | | | | | |
| | | 7 | M. turriculatus | | 585' ? Retialites perlatus var dairani DiPlagraptus cf. tamariscus var incertus M. spiralis, M. cf. communis M. cf. leptatheca M. cf. intermedius | | | 2070' M. turriculatus M. exiguus M. cf. spiralis M. cf. halli M. convolutus var A Petalagraptus palmeus var. tenuis ? | 5020' Retialites geinitzianus M. turriculatus M. exiguus M. marri M. aff. planus | | | |
| | CLAN DOVEN | 6 | M. sedgwicki | | | | | | | | | |
| | | 5 | M. convolutus | 704' Rastrites hybridus | | | | 1800' M. convolutus M. leptatheca ? M. cf. pandus M. cf. delicatulus Retialites cf. perlatus | | | 720' M. nudus ? M. communis var. A | 384' M. convolutus M. gemmatus M. cf. crenularis M. cf. jaculum M. undulatus ? |
| | | 4 | M. gregarius | | | | | | | | | |
| | | 3 | M. cyphus | | | | | | | | | |
| 2 | | Mesograptus modestus | | | | | | | | | | |
| 1 | | Cephelagraptus acuminatus | | | | | | | | | | |

TABLE TWO: CORRELATION OF SILURIAN GRAPTOLITE FAUNA OF THE AREA

[illegible]

CHAPTER 3

SYSTEMATIC PALAEOLOGY

11.
SYSTEMATIC PALAEONTOLOGY CLASSIFICATION TABLE

Subphylum STOMOCHORDA Dawydoff, 1948

Class GRAPTOLITHINA Bronn, 1846

Order DENDROIDEA Nicholson, 1872

Family DENDROGRAPTIDAE Roemer (in Frech) 1897

Genus DENDROGRAPTUS Hall, 1858

Dendrograptus flexuosus Hall

Dendrograptus sp., aff. D. fruticosus Hall

Dendrograptus sp., cf. D. thomasi Ruedemann

Genus CALLOGRAPTUS Hall, 1865

Callograptus salteri Hall

Callograptus staufferi Ruedemann

Genus DICTYONEMA Hall, 1851

Dictyonema flabelliforme Eichwald

Dictyonema murrayi Hall

Dictyonema quadriangulare Hall

Dictyonema robustum Hall

Family ANISOGRAPTIDAE Bulman, 1950

Genus ANISOGRAPTUS Ruedemann, 1937

Anisograptus richardsoni Bulman

Genus BRYOGRAPTUS Lapworth, 1880

Bryograptus lapworthi Ruedemann

Bryograptus pusillus (?) Ruedemann

Genus CLONOGRAPTUS Hall and Nicholson, 1873

Clonograptus flexilis Hall

Clonograptus tenellus (?) Linnarsson

Clonograptus sp. A

Clonograptus (?) sp.

Genus STAUROGRAPTUS Emmons, 1855

Staurograptus dichotomus var. apertus Ruedemann

Triograptus osloensis Monsen

Family ACANTHOGRAPTIDAE Bulman, 1938

Genus ACANTHOGRAPTUS Spëncer, 1878

Acanthograptus sp.

Family CHAUNOGRAPTIDAE Bulman, 1955

Genus CHAUNOGRAPTUS Hall, 1883

Chaunograptus sp.

Order GRAPTOLOIDEA Lapworth, 1875

Family DICHOGAPTIDAE Lapworth, 1873

Genus LOGANOGRAPTUS Hall, 1868

Loganograptus logani Hall

Loganograptus logani var. pertenuis Ruedemann

Genus TEMNOGRAPTUS Nicholson, 1876

(?) Temnograptus ramulus Hall

Genus DICHOGAPTUS Salter, 1863

Dichograptus maccoyi Harris and Thomas

Dichograptus n. sp. A

Dichograptus n. sp. B

Genus TETRAGRAPTUS Salter, 1863

Tetragraptus amii Lapworth

Tetragraptus approximatus Nicholson

Tetragraptus lavalensis Ruedemann

Tetragraptus pendens Elles

Tetragraptus putillus Ruedemann

Tetragraptus quadribrachiatus Ruedemann

Tetragraptus Scandens var. curvatus Ruedemann

Genus PHYLLOGRAPTUS Hall, 1858

Phyllograptus anquistifolius Hall

Phyllograptus sp., cf. P. anquistifolius var. magnificus, Ruedemann

Phyllograptus anna mut. longus Ruedemann

Phyllograptus anna mut. ultimus Ruedemann

Genus DIDYMOGRAPTUS McCoy, 1851

Didymograptus cuspidatus Ruedemann

Didymograptus euodus Lapworth

Didymograptus extensus Hall

Didymograptus extenuatus Hall

Didymograptus nicholsoni Lapworth

Didymograptus nitidus (?) Hall

Genus ISOGRAPTUS Moberg, 1892

Isograptus caduceus Salter

Isograptus caduceus mut. nanus Ruedemann

Isograptus caduceus var. A

Isograptus forcipiformis Ruedemann

Genus novum cf. Isograptus

Family CRYPTOGRAPTIDAE Hadding, 1915

Genus CRYPTOGRAPTUS, Lapworth, 1880

Cryptograptus antennarius Hall

Genus GLOSSOGRAPTUS Emmons, 1855

Glossograptus ciliatus var. A

Glossograptus horridus (?) Ruedemann

Family DICRANOGRAPTIDAE Lapworth, 1873

Genus DICRANOGRAPTUS Hall, 1865

Dicranograptus sp., cf. D. spinifer, Lapworth

Family DIPLOGRAPTIDAE Lapworth, 1873

Subfamily CLIMACOGRAPTINAE Frech, 1897

Genus CLIMACOGRAPTUS Hall, 1865

Climacograptus bicornis Hall,

Climacograptus brevis Elles and Wood

Climacograptus sp., cf. C. latus Elles and Wood

Climacograptus tridentatus var. maximus Decker

Climacograptus sp. A

Subfamily DIPLOGRAPTINAE Lapworth, 1873

Genus DIPLOGRAPTUS M'Coy, 1850

Diplograptus (Glyptograptus) dentatus (?) Brongniart

Diplograptus (Amplexograptus) sp., cf. D. perexcavatus Lapworth

Diplograptus (Glyptograptus) sp., cf. D. teretiusculus var.

siccatus Elles and Wood

Diplograptus (Glyptograptus) sp., cf. D. tamariscus var.

incertus Elles and Wood

Diplograptus sp., cf. D. truncatus var. intermedius Elles and Wood

Diplograptus (Glyptograptus) vespertinus (?) Ruedemann

Subfamily PETALOGRAPTINAE Bulman, 1955

Genus PETALOGRAPTUS Suess, 1851

Petalograptus palmeus var. tenuis (?) Barrande

Family (?) DIPLOGRAPTIDAE INCERTAE SEDIS

Genus TRIGONOGRAPTUS Nicholson, 1869

Trigonograptus ensiformis Hall

Family LASIOGRAPTIDAE Bulman, 1955

Genus LASIOGRAPTUS Lapworth, 1873

Lasiograptus echinatus Ruedemann

Subfamily RETIOLITINAE Lapworth, 1873

Genus RETIOLITES Barrande, 1850

Retiolites geinitzianus Barrande

Retiolites sp., cf. R. perlatus Nicholson

Retiolites perlatus var. daironi Lapworth

Family MONOGRAPTIDAE Lapworth, 1873

Subfamily MONOGRAPTINAE Lapworth, 1873

Genus MONOGRAPTUS Geinitz, 1852

Monograptus sp., cf. M. communis Lapworth

Monograptus communis var. A

Monograptus convolutus Hisinger

Monograptus convolutus var. A

Monograptus sp., cf. M. crenularis Lapworth

Monograptus sp., cf. M. crinitus Wood

Monograptus sp., cf. M. delicatulus Törnquist

Monograptus exiguus Nicholson

Monograptus gemmatus Barrande

Monograptus sp., cf. M. gotlandicus Perner

Monograptus sp., cf. M. halli Barrande

Monograptus sp., cf. M. intermedius Carruthers

Monograptus sp., cf. M. jaculum Lapworth

Monograptus leptotheca(?) Lapworth

Monograptus marri (?) Perner

Monograptus nils~~son~~i Barrande

Monograptus nudus (?) Lapworth

Monograptus sp., cf. M. pandus Lapworth

Monograptus sp., aff. M. planus Barrande

Monograptus riccartonensis Lapworth

Monograptus spiralis (?) Geinitz

Monograptus turriculatus Barrande

Monograptus sp., cf. M. ultimus Perner

Monograptus undulatus Elles and Wood

Monograptus vomerinus Nicholson

Monograptus vomerinus var. gracilis Elles and Wood

Monograptus vulgaris var. curtus Wood

Monograptus sp. A

Genus RASTRITES Barrande, 1850

Rastrites hybridus Lapworth

Subfamily CYRTOGRAPTINAE Bouček, 1933

Genus CYRTOGRAPTUS Carruthers, 1867

Cyrtograptus kindlei var. A

Genus LINOGRAPTUS Frech, 1897

Linograptus phillipsi var. multiramosus Decker

DESCRIPTION OF SPECIES

Genus DENDROGRAPTUS

Dendrograptus flexuosus Hall

Plate 4 , figure 7; Plate 2, figure 2

1865 Dendrograptus flexuosus Hall, G.S.C., dec.2, p.127, text fig.3,
pl.17, figs.1,2.

1904 Dendrograptus flexuosus Hall. Ruedemann, N.Y. State Mus., Mem.7,
p.579, pl.4, figs.5-8.

1947 Dendrograptus flexuosus Hall, Ruedemann, G.S.A. Mem.19, p.214,
p.20, figs.4-9.

Horizon and Locality Locality L61-370, "Janey" River, Yukon Terr.,
in zone of Didymograptus beds (Lower Ordovician).

Description Polypary small, broadly fan shaped, commences from broad
stem and base. Stipes broadly flexuous, 0.3 mm. wide, thin
distally, bifurcate at fairly regular intervals, and diverge
at varying angles.

Discussion A specimen from Locality L61-1615, on "Janey" River, is
slightly more robust than the above species, There is a
probability that this is another species, or a variation
of D. flexuosus. However, because of the lack of better
literature on dendroid graptolites, it is with some
hesitation identified as this species.

Type Locality Deepkill shale, New York.

MEMORANDUM FOR THE RECORD

DATE: 10/10/54

TO: THE CHIEF OF BUREAU

FROM: MR. [Name] (100-100000)

SUBJECT: [Subject]

1. [Text]

2. [Text]

3. [Text]

4. [Text]

5. [Text]

6. [Text]

7. [Text]

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18. [Text]

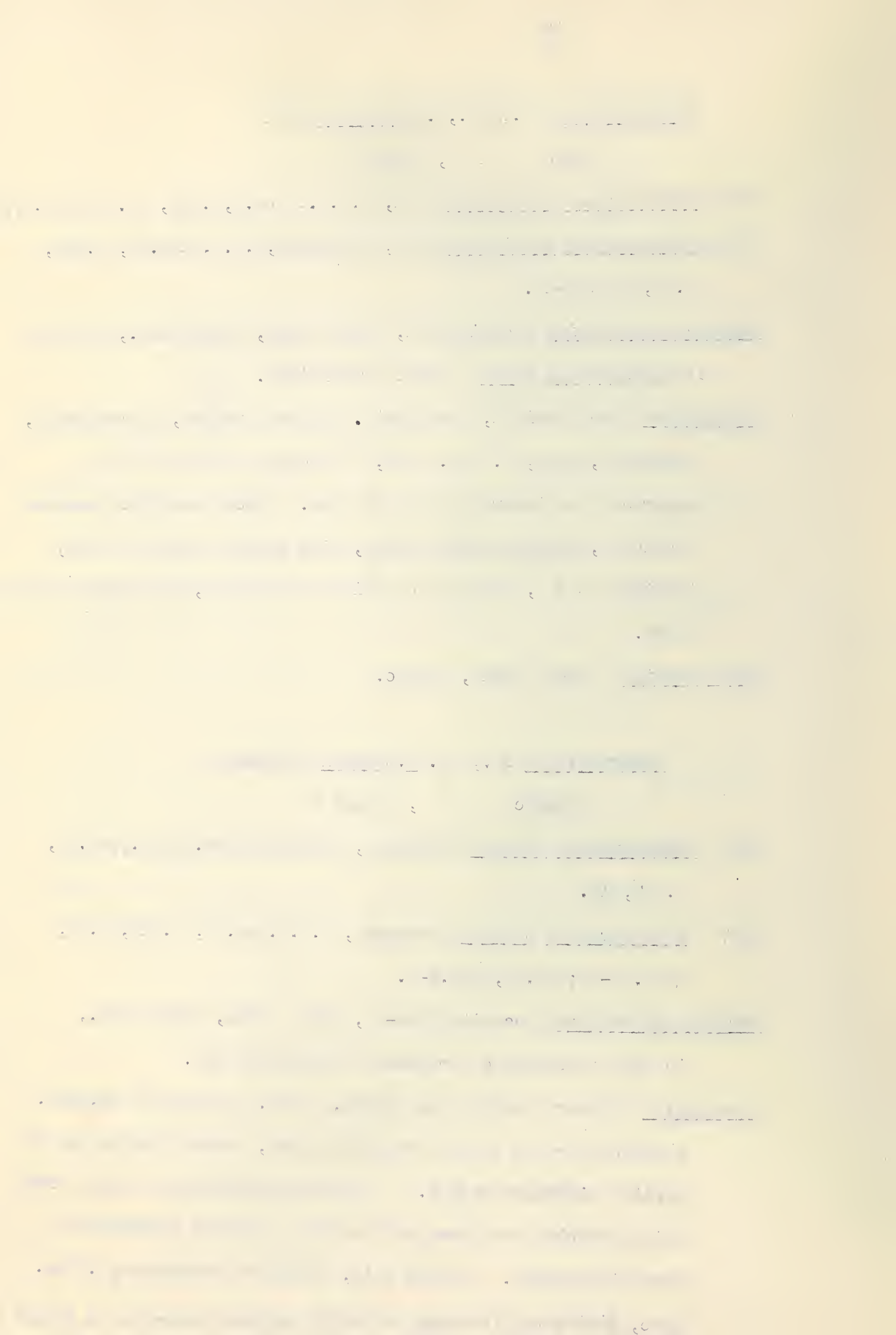
Dendrograptus sp., aff., D. fruticosus Hall

Plate 1 , figure 6

1865 Dendrograptus fruticosus Hall, G.S.C., dec.2, p.131, pl.17 figs.8,9.1947 Dendrograptus fruticosus Hall, Ruedemann, G.S.A. Mem.19, p.215,
pl.20, figs.12-14.Horizon and Locality Locality K61, Trail River, Yukon Terr., in zone
of Phyllograptus typus (Lower Ordovician).Description Frond conical, incomplete. Stipes straight, almost rigid,
divergent, long, 0.7 mm. wide, bifurcate at about 30° ,
apparently at intervals of 2 to 9 mm. Thecae straight somewhat
mucronate, showing growth rings, five times as long as wide,
inclined at 20° , overlap one third to one half, and number 16 in
10 mm.Type locality Levis shale, Quebec.Dendrograptus sp., cf. D. thomasi Ruedemann

Plate I , figure 7

1933 Dendrograptus thomasi Ruedemann, Milwaukee Mus., Bull., vol.12,
p.317, 318.1947 Dendrograptus thomasi Ruedemann, G.S.A. Mem.19, p.213, pl.18,
figs.20-26; pl.19, figs.1-4.Horizon and Locality Locality K62B-20, Trail River, Yukon Terr.,
in beds of Tremadoc (lowermost Ordovician) age.Description Polypary roughly fan shaped, 15 mm. long and 20 mm. wide,
commences from a single stem-like stipe, which branches out at
greatly different angles. Frond has appearance of trunk from
which branches are given off at fairly regular intervals in
tree-like manner. Stipes thin, curved or undulating, 0.3 mm.
wide, divide by dichotomy at fairly regular intervals at $30-40^{\circ}$.



Thecal outline not present.

Discussion This species is quite common and shows considerable variation in form. In some, the branches may be wider (0.6 - 0.8 mm.) and the frond may be considerably broader. One specimen has the appearance of Desmograptus sp., but absence of anastomosis precludes this generic designation.

Type Locality Levis Shale, Quebec.

Callograptus staufferi Ruedemann

Plate 2 , figure 3

1933 Callograptus staufferi Ruedemann, Milwaukee Mus. Bull., vol. 12, p. 319 pl. 50, figs. 1-7; pl. 55, figs. 1, 2, 6.

1947 Callograptus staufferi Ruedemann, G.S.A. Mem. 19, p. 204, pl. 16, figs. 7-15; pl. 15, fig. 16.

Horizon and Locality Locality K 62B -120, Trail River, Yukon Terr., in beds of lowermost Lower Ordovician age.

Description Polypary small, rather broadly conical, 15 mm. wide and about 20 mm. long, with dendroid appearance. Stipes irregular, undulating, sometimes curved, divide by irregular but frequent intervals of 1-3 mm. They are 0.4 mm. wide, subparallel to slightly diverging, and separated by spaces of 0.2 - 0.6 mm.

Type locality Trempealeau formation, Afton, Minnesota.

Genus DICTYONEMA

Dictyonema flabelliforme (Eichwald)

Plate I , figure 5

1840 Gorgonia flabelliforme Eichwald, Sil. Schicht. Syst. in Esthland, p. 207

1881 Dictyonema flabelliforme (Eichwald). Malaise, Doc. Pal. Rel. au terr. Camb. de l'Ardenne.

1904 Dictyonema flabelliforme (Eichwald). Ruedemann, N.Y. State Mus.,
Mem. 7, p. 599, text figs. 26, 27, pl. figs. 1-22.

1947 Dictyonema flabelliforme (Eichwald). Ruedemann, G.S.A. Mem. 19, p. 159
pl. 2, figs. 22, 23.

Horizon and Locality Locality K 62B-60, Trail River, Yukon Terr., in
D. flabelliforme zone (lowermost Lower Ordovician).

Description Frond fan shaped, 35 mm. long and 40 mm. wide. Begins from
small pointed sicula which gives off one branch about half way
down from apex; branch bifurcates immediately; another branch
grows out orally from sicula, giving an initial three stiped
frond. Stipes bifurcate fairly regularly from 2 - 4 mm. They
are 0.5 mm. wide, separated by nearly equal spaces. Dissep-
iments vague but appear to be quite regular. Branches sub-
parallel.

Discussion This specimen resembles the holotype in nearly every
respect, except that branches are somewhat more closely set.
Two other specimens from the same locality are similar to the
above specimen and are identified as Dictyonema sp., cf. D.
flabelliforme.

Type Locality Schaghticoke shale, Schaghticoke, New York.

Dictyonema murrayi Hall

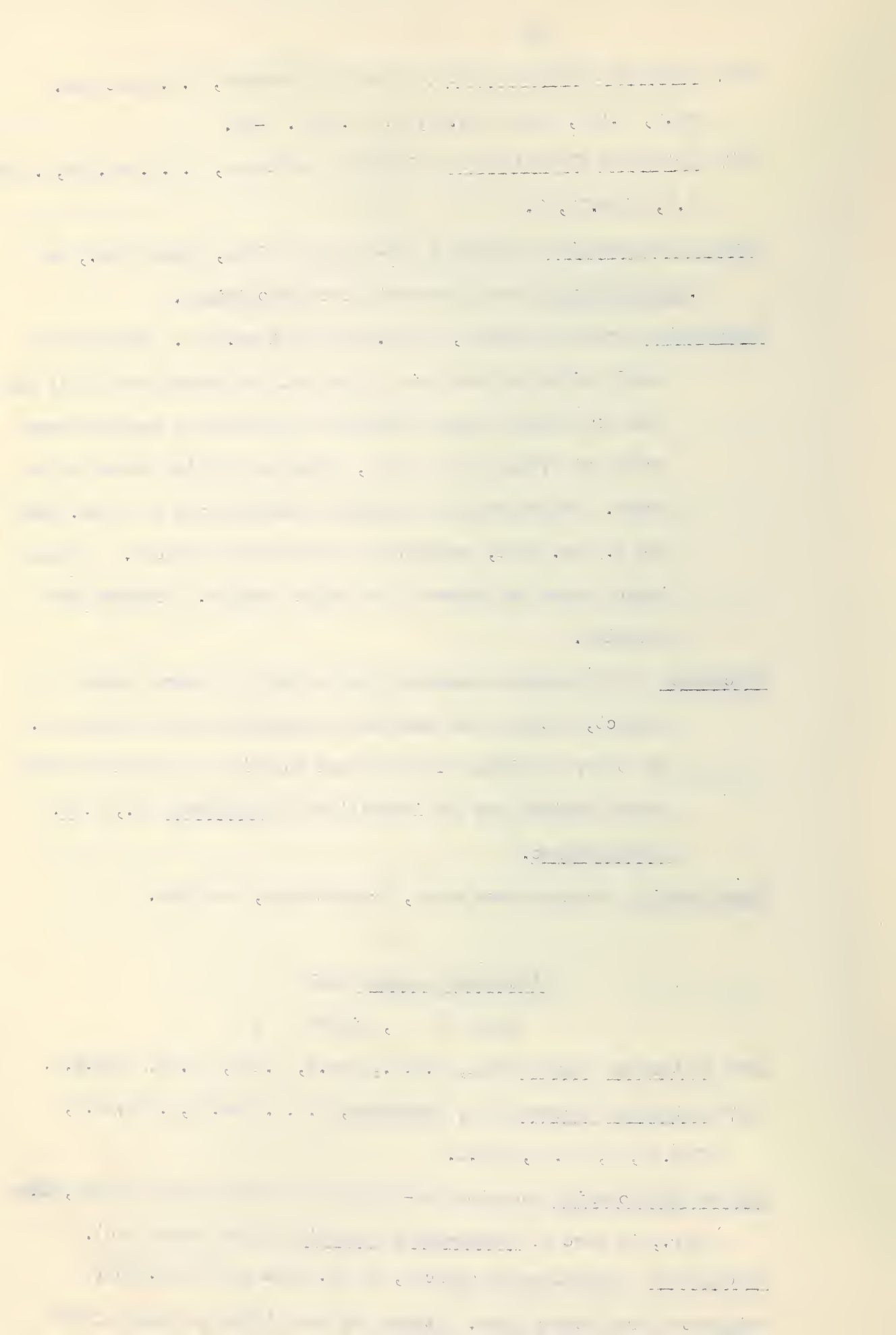
Plate I , figure I

1865 Dictyonema murrayi Hall, G.S.C., dec. 2, p. 138, pl. 20, figs. 6, 7.

1947 Dictyonema murrayi Hall, Ruedemann, G.S.A. Mem. 19, p. 171, pl. 4,
figs. 15, 16, pl. 10, fig. 1.

Horizon and Locality Locality R16-4303, Upper Canyon of Peel River, Yukon
Terr., in zone of Clonograptus flexilis (Lower Ordovician).

Description Synrhabdosome conical, 60 mm. wide and 50 mm. long,
originates from common base. Stipes fan out within an angle of 60°



and divide by dichotomy. First dichotomy occurs close to base, later dichotomies occur at irregular but increasing intervals. Branches straight, parallel to subparallel, with uniform width of 1 mm. Dissepiments join stipes on either side at alternate intervals, are 1-1.2 mm. long; width varies from very thin to slightly less than width of stipe. They form rectangular meshes 1.5 - 2 mm. long.

Type Locality Levis shale, Quebec.

Dictyonema quadriangulare Hall

Plate I , figure 8

- 1865 Dictyonema quadriangularis Hall, G.S.C., dec. 2 pl. 138, pl. 20, fig. 5
 1915 Dictyonema quadriangulare Hall, Bassler, U.S. Nat. Mus., Bull. 92, p. 426
 1947 Dictyonema quadriangulare Hall, Ruedemann, G.S.A. Mem. 19, pl. 174, pl. 10, fig. 6.

Horizon and Locality Locality L44-40, Lower Canyon of Peel River, Yukon Terr., in zone of Clonograptus flexilis (Lower Ordovician).

Description Only small portion of synrhabdosome present but obviously conical. Stipes divide at intervals by dichotomy, are parallel to slightly diverging and 1 mm. wide throughout. Joining at alternate intervals on either side of stipes are dissepiments which are one half to two thirds width of stipe and 1.5 - 2 mm. long. They form sharp cornered, nearly square meshes.

Type Locality Levis Shale, Quebec.

Dictyonema robustum Hall

Plate I , figure 4

- 1865 Dictyonema robusta Hall, G.S.C., dec. 2, p. 137, pl. 20, figs. 3, 4
 1915 Dictyonema robustum Hall, Bassler, U.S. Nat. Mus., Bull. 92, p. 426

1947 Dictyonema robustum Hall. Ruedemann, G.S.A. Mem. 19, p. 175, pl. 10
figs. 4, 5

Horizon and Locality Locality L44-480-500, Lower Canyon of Peel River,
Yukon Terr., in zone of Phyllograptus typus(?) (Lower
Ordovician).

Description Basal portion of frond present, narrowly cone shaped.

Stipes closely set, apparently bifurcate at somewhat regular
intervals, 1.2 mm. wide, subparallel. Dissepiments join stipes
at alternating and approximately equal intervals and are same
width as stipes, 0.7-1 mm. long, form elongate, subrectangular
to polygonal meshes varying from 1 to 2 mm. in length.

Type Locality Levis shale, Quebec.

GENUS ANISOGRAPTUS

Anisograptus richardsoni Bulman

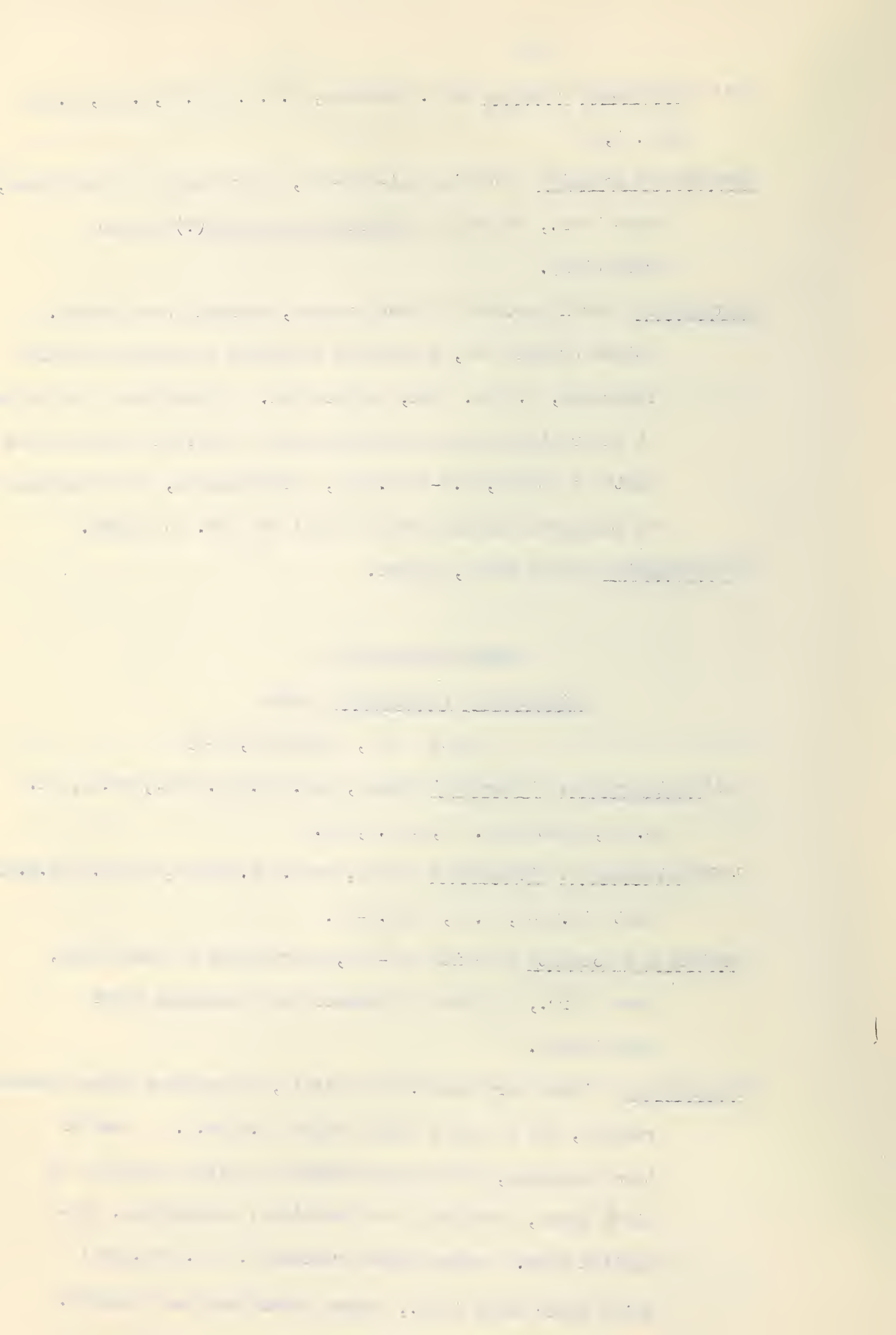
Plate 2 , figures 8, 11-13

1941 Anisograptus richardsoni Bulman, Ann. Mag. Nat. Hist., ser. 11, vol. 7
p. 109, text figs. 2 a, b, pl. 2, fig. 6

1950 Anisograptus richardsoni Bulman, Geol. Soc. London, Quart. Jour. p. 85
text fig. 7a-h, p. 16, figs. 8-12.

Horizon and Locality Locality L44-150, Lower Canyon of Peel River,
Yukon Terr., in beds of Tremadoc age (lowermost Lower
Ordovician).

Description Sicula very small. From sicula, three first order branches
radiate, all of about equal length (0.8 mm.). Each in
turn bifurcate, and continue doing so fairly regularly to
fifth order, resulting in a beautiful, symmetrical, tri-
radiate form. Second order branches 2.3 -2.6 mm. long;
third order about 4 mm., fourth order long and flexuous.



First two orders straight, thereafter flexuous. Atheciferous portion of stipes have uniform width of 0.25 mm., theciferous portion 0.3 - 0.4 mm. Thecae slightly curved distally, 1.2 mm. long, overlap only very slightly, four times as long as wide, inclined at 15-20° and number 10-11 in 10 mm. Apertural margins straight, form acute angles with thecal axes.

Discussion The regular triradiate form, the thin stipes and regular bifurcation are diagnostic of the species. At locality R12-420, the Road River tributary, is a specimen which agrees with the above in nearly all ways, but shows a somewhat less symmetrical form. Several growth stages are represented at this locality and some thecae are beautifully preserved as "three dimensional" tubes.

Type locality Matanne shale (? Upper Tremadoc), Cape Rosier, Que.

GENUS BRYOGRAPTUS

Bryograptus lapworthi Ruedemann

Plate 5 , figures 1 - 4

1902 Bryograptus sp. Ruedemann, N.Y. State Pal., Ann. Rept., p. 556

1904 Bryograptus lapworthi Ruedemann, N.Y. State Mus., Mem. 7, p. 639, text fig. 47, pl. 5, figs. 1-12.

1947 Bryograptus lapworthi Ruedemann, G.S.A. Mem. 19, p. 298, pl. 49, figs. 7-16.

Horizon and Locality Locality L44-440, Lower Canyon of Peel River, Yukon Terr., in zone of Clonograptus flexilis (Lower Ordovician).

Description Total length of rhabdosome 11 mm. Sicula somewhat conical in shape, 1.2 mm. long. Attached to the apex of sicula is a thin nema. Two stipes, one near aperture, the other about one third distance above aperture, grow down from sicula giving an initial asymmetrical appearance. After the

second thecae, stipes tend to straighten and become nearly horizontal. About 2.5 mm. from sicula another stipe grows downward from each main stipe at low angle of about 20° . Stipes nearly straight, delicate, 0.4 mm. wide. Thecae very well preserved in three dimensions in the mature specimen. They are subcylindrical, separated from the next by a distinct furrow, overlap one third to one half their length, 1.2 mm. long, four times as long as wide, inclined at $15-20^{\circ}$ and number 10-11 in 10 mm. They are nearly tubular, but become conical at point of attachment and widen slightly at aperture. Apertural margins straight, slightly concave, at right angles to thecal axes.

Discussion A nearly complete ontogeny of this specimen is preserved at this locality. It matches the holotype in nearly all respects, so the writer has little hesitation in assigning it to that species. The mature specimen is very unusual in that the thecae are so well preserved as to show growth lines.

Type locality Deepkill formation, New York.

Bryograptus pusillus (?) Ruedemann

Plate 5 , figure 5

1902 Bryograptus kjerulfi Ruedemann, N.Y. State Pal., Ann. Rept., p. 556

1904 Bryograptus pusillus Ruedemann, N.Y. State Mus., Mem. 7, p. 641, pl. 4
figs. 21, 22.

1947 Bryograptus pusillus Ruedemann, G.S.A. Bull. Mem. 19, p. 299, pl. 49
figs. 3-6.

Horizon and Locality Locality 144-440, Lower Canyon of Peel River,
Yukon Terr., corresponding to zone three of Deepkill.

Description Sicula broad, 1 mm. long. Two stipes diverge suborally

at 70° and at different levels from sicular. Secondary stipe grows out at angle of about 80° from long theca of higher primary stipe, resulting in three branched rhabdosome. Stipes short and very thin (0.4 mm. maximum width). Thecae delicate, long and narrow, 1.2 mm. long, overlap one quarter length proximally to one third length distally, inclined at 15° and (apparently) number 8-9 in 10 mm. Thecal walls straight, except distal end curved up sharply to form mucrons. Apertural margins slightly curved, ^{and} form acute angles with thecal walls, accentuating pointed nature of thecae.

Discussion This specimen differs from the holotype in apparently having proportionately fewer thecae, but since only two are preserved on the stipe, their exact number is impossible to ascertain.

Type Locality Deepkill formation, New York.

GENUS CLONOGRAPTUS

Clonograptus flexilis (Hall)

Plate 2 , figure 16

- 1858 Graptolithus flexilis Hall, G.S.C., Rep't for 1857, 1858, pp.119,145.
 1865 Graptolithus flexilis Hall, G.S.C., dec.2, p.11, fig.8, p.103, pl.10
 figs.3-9.
 1893 Clonograptus flexilis (Hall). Mathew, Royal Soc. Can., Trans., vol.10,
 Sec.4, p.97.
 1937 Clonograptus flexilis (Hall). Monsen, Norsk Geol. Tidssk., bd.16, p.195,
 pl.6, figs.1,3,8.
 1947 Clonograptus flexilis (Hall). Ruedemann, G.S.A. Mem.19, p.280, pl.44,
 figs. 4-9.

Horizon and Locality Locality 144-480-500, Lower Canyon of Peel River,

Yukon Terr., approximately equivalent to zone of Phyllograptus typus (Lower Ordovician).

Description Frond with dichotomies to fifth order taking place, rather symmetrically on either end of funicle, at ever increasing lengths. Funicle 1.8 mm. long. Second order branches 2 mm. long, third order 3-4 mm. long, fourth order 6 mm. long, and fifth order 14-15 mm. long and flexuous. Bifurcations occur at 105° , 80° , $50-60^{\circ}$ and 45° on first, second, third and fourth dichotomies, respectively. Stipes straight for first two orders, thereafter curved, about 0.6-0.7 mm. wide throughout. Only fourth and fifth order branches have thecae. Thecae straight, 1.5 mm. long, four times as long as wide, overlap one third to one half, inclined at $20 - 25^{\circ}$ and number 9-10 in 10 mm. Apertural margins straight, perpendicular to thecal axes.

Discussion This species is distinguished from C. rigidus by the more flexuous character of the stipes, and according to Monsen (1937) by the greater number of thecae. Two other specimens from the Upper Canyon of the Peel show slight variation in length of various dichotomies but are otherwise as above. These are identified as Clonograptus sp., cf. C. flexilis.

Type Locality Lewis Shale, Levis, Quebec.

Clonograptus tenellus(?)(Linnarson)

Plate 2 , figure 9

1871 Dichograptus tenellus Linnarson, Ofv. Kongl. V et. Akad. Förh., Stockholm, vol. 28, no. 6, p. 795.

1901 - 1918 Clonograptus tenellus (Linnarson). Elles and Wood, Mon. Brit. Grapt., p. 83, pl. II, figs. 2a-c.

Horizon and Locality Locality R16-3955, Upper Canyon of Peel River, Yukon Terr., in beds of Tremadoc age (lowermost Lower Ordovician).

Description Two long, slender, curved branches, each containing about seven thecae grow out from either side of 0.4 mm. long sicula and produce very long slender funicle 12 mm. long. These in turn bifurcate at 80° forming second order branches 10 mm. long. Third order dichotomy produces branches 15 mm. long. Total length of fourth order stipes unknown, but apparently greater than 15 mm. Stipes very slender, 0.2 mm. wide, delicate, and somewhat flexuous. Thecae simple and conical, cylindrical in cross section, but most flattened by compression. Some beautifully preserved showing growth lines clearly. Thecae mucronate, widen distally, three times as long as wide, overlap scarcely at all, 1 mm. long, inclined at 15° and number 9-10 in 10 mm. First and second order branches may be supported by thin membrane, scarcely wider than stipes, running entire length of branch.

Discussion This is the only specimen of this species found. Although the thecae are shorter than those described by Elles and Wood, this specimen matches the holotype very well. The conical ~~shape~~ thecae with their well developed mucrons ^{are} ~~is~~ very diagnostic of this species.

Type Locality Tremadoc beds, Lower Skiddaw shale, Great Britain.

Clonograptus sp.A

Plate 2 , figures 6,7.

Horizon and Locality Locality RL6-3790, Upper Canyon of Peel River , in beds of Tremadoc age (Lowermost Lower Ordovician).

Description Sicula 0.8 mm. long in some specimens; may be present in profile view, or as bump or depression on funicle. Primary branches grow out suborally from funicle. Funicle varies in length from 0.9 -1.3 mm. in different specimens, and is formed of one theca on each

side of sicula. Dichotomies occur at irregular intervals up to fifth order. Initial dichotomies at 80° - 100° forming second order branches 0.6 - 1.3mm. long, third order at 70° - 80° , forming branches 0.7-3 mm. long, fourth order at 60° , forming branches 1-5 mm. long; and fifth order at 45° , forming branches of unknown length. Stipes 0.2 mm. wide in atheciferous portions, 0.3 mm. with thecae, generally straight. Thecae preserved on only few stipes, straight, small, 1 mm. long, four times as wide, overlap one eighth to one quarter, inclined at 15° and number 11 in 10 mm. Apertural margins straight, perpendicular to thecal axes.

Discussion Myriads of overlapping rhabdosomes of this species occur in the shale at this locality, making a single isolated one difficult to find. Except for the presence of sicula in the centre of the funicle, this specimen would be confused with Anisograptus sp. It has affinities with Clonograptus tenellus but differs in its much shorter stipes, and tiny nonmucronate thecae. It is characterized by its small size, the irregular and variable lengths of stipes of the same order. By the very fact of its small size, the stipes appear thick in comparison.

Clonograptus (?) sp.

Plate 2 , figure 15

Horizon and Locality Locality 144-600, Lower Canyon of Peel River, Yukon Terr., approximately equivalent to zone of Didymograptus bifidus (Lower Ordovician).

Description Funicle thin, 1.5 mm. long. Branches bifurcate at roughly equal intervals of 4 - 6 mm. up to fifth order dichotomy. First bifurcation at 105° , thereafter about 45° . Stipes very thin, occasionally slightly flexed but generally straight, of uniform width of 0.3 mm. Thecae represented only by thin horizontal lines on stipe, number 10-11 in 10 mm., commence on second order branches.

Discussion This undiagnostic and poorly preserved specimen differs from known Clonograptids in the thinness^{and} equal length of the stipes, and is not sufficiently well preserved or developed to permit specific determination. It occurs in a much higher horizon than previously described *species*.

Genus STAUROGRAPTUS

Staurograptus dichotomous var. apertus Ruedemann

Plate 2 , figures 5, 14

1904 Staurograptus dichotomous Emmons. var. apertus Ruedemann, N.Y.
State Mus. Mem. 7, p. 617, pl. 2, fig. 21.

1947 Staurograptus dichotomous Emmons var. apertus Ruedemann, G.S.A.
Mem. 19, p. 291, pl. 46, fig. 19-21.

1950 Staurograptus dichotomous Emmons var. apertus Ruedemann, Bulman,
Geol. Soc. London, Quart. Jour., p. 91, text fig. 9, pl. 7, fig. 1-4;
pl. 8, fig. 5.

Horizon and Locality Locality L44 -150, Lower Canyon of Peel River,
Yukon Terr., in beds of Tremadoc age.

Description Sicular present, but not well preserved. Growing out at right angles to each other and from common centre are four primary stipes which bifurcate at 60° within 2-3 mm. Bifurcations continue to third order. Stipes of first and second orders

straight, but third order may be flexed. Stipes of nearly uniform width of 0.3 mm. Thecae nearly invisible, but appear inclined at low angle.

Discussion The quadriradiate branching from a common centre, and the thinness of stipes is very diagnostic of this variation. At Locality Rl6-4020 in the Upper Canyon of the Peel, is a specimen in which only one half of the rhabdosome is present. The stipes appear to originate from a common centre and are thin (0.4 mm.) and flexuous. The thecae are poorly preserved, but number about 10-11 in 10 mm. This is considered the same variation.

Type Locality Schaghticoke Shale (Tremadoc), New York.

Genus TRIOGRAPTUS

Triograptus osloensis Monsen

Plate 2 , figure 4

1925 Triograptus osloensis Monsen, Norsk.Geol.Tidsskr., Bd.8, p.168, pl.3, figs.1-12; pl.4, figs.1-3.

1947 Triograptus osloensis Monsen. Ruedemann, G.S.A. Mem.19, p.321 pl.53, figs.41-44.

Horizon and Locality Locality Rl6-4020, Upper Canyon of Peel River, Mukon Terr., in beds of Tremadoc age.

Description Only part of sicula present. Three single stipes grow out approximately 60° to one another from sicula and form simple triradiate rhabdosome. Stipes straight, 0.4 mm. wide in atheciferous portions, 0.5 mm. wide in theciferous portions, and about 5.5 mm. long. Apertures of thecae on all three branches point away from sicula. Thecae simple, somewhat mucronate, slightly curved distally, 1.3 mm. long, four times as long as wide, overlap one third to one-half, inclined at 20° - 25° and number 11-12

10

in 10 mm. Apertural margins slightly concave, perpendicular to thecal axes.

Discussion The simple triradiate structure of the rhabdosome with all thecae pointing outward is very characteristic of this genus and species. It has been reported previously from only ~~two~~ two other localities; Norway; and Matanne Shale, Quebec.

Type Locality Norway: Lower Ordovician, in unnamed formation.

Genus ACANTHOGRAPTUS

Acanthograptus Sp.

Plate I , figure 2

Horizon and Locality Locality K73-1480-1560, "Janey" River, Yukon Terr., in zone of Diplograptus dentatus (uppermost Lower Ordovician).

Description Frond of dendroid pattern. Main branches 0.5 mm. wide. Branches straight to curved and divide at close intervals by giving off secondary branches and by dichotomy. Each of these branches gives off smaller branches. Thecae apparently number 15 in 10 mm., and possess long mucrons, giving branches a very ragged and shrub-like look.

Discussion This specimen has affinities with A.ottoseensis but differs in the shape of branches and in the number of thecae.

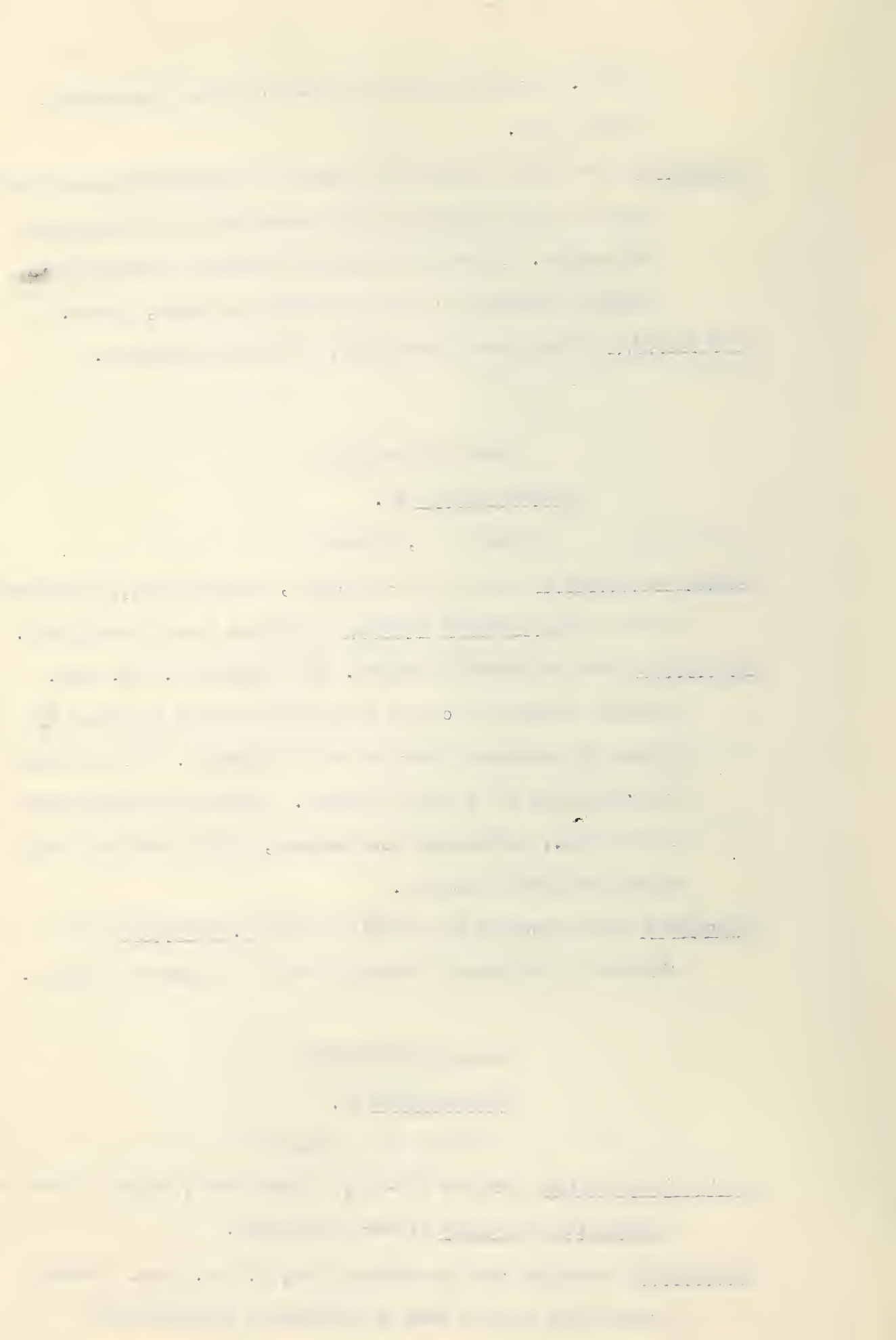
Genus CHAUNOGRAPTUS

Chaunograptus sp.

Plate 1, figure 3

Horizon and Locality Locality K73-500, "Janey" River, Yukon, in zone of Clonograptus flexilis (Lower Ordovician).

Description Straight rod-like central stem, 0.2 mm. wide. Growing from either side of stem at alternating intervals are



elongate, narrow, cone shaped thecae, inclined at 60° , attaining uniform length of 0.6 mm.

Discussion This specimen appears to have affinities with no other species in its rigid, symmetric appearance.

Genus LOGANOGRAPTUS

Loganograptus logani (Hall)

Plate 4 , figure I

- 1858 Graptolithus logani Hall, G.S.C., Rep't Progr. 1857, 1858, p. 115
- 1865 Graptolithus logani Hall, G.S.C., dec. 2, p. 100, text figs. 5, 6, pl. 9, figs. 1-9; pl. 11, fig. 7.
- 1867 Loganograptus logani (Hall), N.Y. State Cab. Nat. Hist., 20th Rep't p. 266.
- 1902 Loganograptus logani (Hall). Elles and Wood, Mon. Brit. Grapt., p. 81, pl. 11, figs. 1 a-g.
- 1904 Loganograptus logani (Hall). Ruedemann, N.Y. State Mus., Mem. 7, p. 631, text fig. 46, pl. 9, figs. 3-6.
- 1947 Loganograptus logani (Hall). Ruedemann, G.S.A. Mem. 19, p. 286, pl. 45, figs. 11-13; pl. 46, figs. 1-2.

Horizon and Locality Locality L44-800, Lower Canyon of Peel River, Yukon Terr., in zone of Diplograptus dentatus (uppermost Lower Ordovician).

Description Funicle 2.5 mm. long. Rhabdosome formed by three short dichotomies of approximately equal length taking place symmetrically at both ends of funicle, followed by fourth order dichotomy, producing long straight stipes. Dichotomies occur at intervals of 1.5 mm. Fourth order stipes 33 mm. long, of uniform width of 0.9 mm. Thecae simple, straight, 1.5 mm. long

three times as long as wide, overlap one half, inclined at 30° and number 9-10 in 10 mm. Apertural margins straight, perpendicular to thecal axes.

Discussion This single, beautiful and complete specimen matches the holotype very well.

Type and locality Levis shale, Levis, Quebec.

Loganograptus logani mut. pertenuis Ruedemann

Plate 4 , figures 3,5,6

1904 Loganograptus logani (Hall) mut. pertenuis Ruedemann, N.Y. State Mus., Mem.7, p.633, pl.9, fig.5.

1947 Loganograptus logani (Hall) mut. pertenuis Ruedemann, G.S.A. Mem.19, p.287, pl.45, figs.14-16.

Horizon and Locality Locality of 144-800, Lower Canyon of Peel River, Yukon Terr., equivalent to uppermost Lower Ordovician

Diplograptus dentatus zone of Deepkill.

Description General shape of rhabdosome like that of holotype of

Loganograptus logani but differs in its much smaller size, and more delicate nature of stipes. Second, third and fourth order dichotomies take place at intervals varying from 0.8 -1.6 mm.

Fourth dichotomy, however, takes place on only two outside stipes, while two inner stipes show no further dichotomy, Some specimens show fifth order dichotomy. Thecae lacking on proximal portion, but developed on distal portion of rhabdosome; ~~stipes 0.6-0.7 mm. wide distally.~~ Thecae simple, straight, four to five times as long as wide, 1 mm. long, overlap one third, inclined at 20° and number 10 in 10 mm.

Discussion All mutations of this species observed are readily recognized. The fourth or fifth order dichotomies and the delicate nature of the rhabdosome are very diagnostic. This

species also occurs at Locality RII-1150,^{the} Road River Tributary.

Type Locality Deepkill fm., New York.

GENUS TEMNOGRAPTUS (?)

(?) Temnograptus ramulus (Hall)

1865 Graptolithus ramulus Hall, G.S.C., dec. 2, p. 108, pl. 12, figs. 9, 10.

1915 Temnograptus ramulus (Hall). Bassler, U.S. Nat. Mus., Bull. 92, p. 1260

1947 Temnograptus ramulus (Hall). Ruedemann, G.S.A. Mem. 19, p. 284, pl. 44, figs. 17-18, pl. 45, figs. 5-8.

Horizon and Locality Locality L44-400, Lower Canyon of Peel River, Yukon Terr., equivalent to zone of Clonograptus flexilis (Lower Ordovician).

Description Rhabdosome 150 mm. wide. Bifurcation up to sixth or seventh order. Bifurcation appears somewhat symmetric. Second order branches 10-12 mm. long, third order 13 mm. long, fourth order 16 mm. long, fifth order 25 mm. long, and sixth order 20 mm. long. Angle of bifurcation initially greater than 90°, thereafter lessening to about 30°. Funicle apparently quite long, possibly 10 mm. long. Stipes slightly flexuous, 1.1-1.2 mm. wide throughout. Thecae not present.

Discussion From its large size and the length of the stipes, this specimen would seem closest to the genus Temnograptus. There is a possibility, however, of it being a Clonograptus, but Clonograptids seldom reach this size, whereas it is apparently fairly common for Temnograptids to do so. The species of Temnograptus with similar dimensions is T. ramulus. It is therefore rather hesitantly assigned to that species, although poor preservation makes positive identification virtually impossible. Because of its poorly preserved nature

this specimen is not illustrated.

Type locality Levis shale, Levis, Quebec.

Genus DICHOGRAPTUS

Dichograptus maccoyi Harris and Thomas

Plate 2 , figure 10

1940 Dichograptus maccoyi, Harris and Thomas, Mining and Geol. Jour.,
Victoria, p.129, pl.I, fig.1a-d; pl.2, fig.2.

Horizon and Locality Locality L44,-600, Lower Canyon of Peel River,
Yukon Terr., and approximately equivalent to zones five and six
of the Deepkill. (Didmograptus and Didymograptus bifidus zone
respectively, Lower Ordovician).

Description Sicula not seen. Funicle 2.5 mm. long; each end of funicle
bifurcates at 110° forming second order branches 1.5 - 2 mm. long;
these bifurcate at 70° , forming a symmetrical rhabdosome of eight
stipes. Stipes straight, rigid, of uniform width of 0.3 mm.
Thecae not preserved in profile view, but represented only by
straight lines on all stipes and apparently number about 10-11
in 10 mm.

Discussion The very narrow width of the stipes, the length of the
funicle compared to the length of the second order stipes, and
the number of thecae are all very diagnostic of this species.
Two other specimens are found at locality L44-440 and agree
with the above description in all respects. The presence of
this species indicates a connection with Pacific Lower
Ordovician faunas.

Type Locality Bendigonian beds, Victoria, Australia.

• 1911-1912 •

c

• 1913-1914 •

• 1915-1916 •

• 1917-1918 •

• 1919-1920 •

• 1921-1922 •

• 1923-1924 •

• 1925-1926 •

• 1927-1928 •

• 1929-1930 •

• 1931-1932 •

• 1933-1934 •

• 1935-1936 •

• 1937-1938 •

• 1939-1940 •

• 1941-1942 •

• 1943-1944 •

• 1945-1946 •

• 1947-1948 •

• 1949-1950 •

• 1951-1952 •

• 1953-1954 •

• 1955-1956 •

Dichograptus sp.A

Plate 3 figure 15

Horizon and Locality Locality L44-600, Lower Canyon of Peel River,
Yukon Terr., in Lower Ordovician beds.

Description Sicular represented by circular depression on thin, 1.5 mm. long funicle. Stipes show bifurcations to third order; second order stipes 2.5 -3 mm. long, third order branches short, apparently not fully developed; stipes of uniform width of 0.3 mm. Thecae preserved only as thin lines on stipe, number apparently 10-11 in 10 mm.

Discussion This species is similar to Dichograptus maccoyi in the width of stipes and number of thecae, but differs in having a relatively short funicle and long second order stipes. It shows considerable stratigraphic range, occurring from the equivalent of zones three to six of the Deepkill and thus would be of no use as a zone marker. Two other specimens were found from localities L44-440 and L44-480-500, which agree with the above description in all details.

Dichograptus sp.B

Plate 3 , figure 16

Horizon and Locality Locality L44-400, Lower Canyon of Peel River,
Yukon Terr., corresponding approximately to zone three or four of the Deepkill (zones of Clonograptus flexilis and Phyllograptus typus, respectively).

Description Funicle very short, 1.7 mm. long; second order branches very long, 7 mm.; third order branches short, 1-2 mm. First dichotomy at 100°, second dichotomy at 60-70°. Width of stipes apparently uniform at 1 mm. Thecae straight tubes, not

too well preserved, inclined about 25° , and apparently number 9 in 10 mm.

Discussion The very long second order stipes and the short funicle removes this species from all other Dichograptid species. Harris and Thomas (1940, p.128) mention but do not describe a similar species with long second order stipes, but also state that it possesses a long funicle. This specimen is therefore considered to be a new species.

Genus TETRAGRAPTUS

Tetragraptus amii Lapworth

Plate 3 , figures 4,12

- 1865 Graptolithus bryonoides Hall, G.S.C., dec.2, p.84, pl.4, figs.9,10.
 1902 Tetragraptus amii Lapworth. Elles and Wood, Mon. Brit. Grapt, p.60
 text fig.36, pl.5, figs.4 a-c.
 1904 Tetragraptus amii Lapworth, Ruedemann, N.Y. State Mus., Mem.7,
 p.647, text figs.53, 54, pl.II, figs.5-7.
 1947 Tetragraptus amii Lapworth. Ruedemann, G.S.A. Mem.19, p.301, pl.50,
 figs.12-14.

Horizon and Locality Locality K73-710, "Janey" River, Yukon Terr.,
 approximately equivalent to zone of Didymograptus beds
 (Lower Ordovician).

Description Sicula represented as depression on funicle. Funicle
 1.3 mm. long and 0.5 mm. wide. Considering it to be vertical,
 four simple undivided branches, two above, and two below,
 develop bilaterally. Two "upper" stipes lie almost horizontal,
 while two lower stipes may diverge about 60° downwards, ^{They are} 1 mm. wide
 at origin, increase width rapidly within the distance of
 three or four thecae, then continue at constant width of 1.9 mm.

Greatest length of stipes 18 mm. Thecae on all four stipes are turned "upwards". Thecae simple, slightly curved distally, three times as long as wide, 2-3 mm. long, depending whether youthful or mature, overlap one half to three quarters their length, inclined at 46° and number 9-10 in 10 mm. Apertural margins slightly concave, and form slight points on thecae.

Discussion Except for a difference in the width of stipes, this form resembles the holotype very well. It is therefore considered to be the same species.

Type Locality Levis Shale, Quebec.

Tetragraptus approximatus Nicholson

Plate 3 , figures 9,10

1873 Tetragraptus approximatus Nicholson, Ann.Mag.Nat.Hist.,ser.4, vol.11, p.136, fig.2.

1947 Tetragraptus approximatus Nicholson, Ruedemann, G.S.A.Mem.19, p.312, pl.52, figs.4-6,17,18.

Horizon and Locality Locality 144-440, Lower Canyon of Peel River, Yukon Terr., in zone of Clonograptus flexilis (Lower Ordovician).

Description Frond consists of four simple undivided stipes arranged bilaterally, two growing from each end of funicle. Stipes leave funicle, diverge rapidly and abruptly, and in about 2 mm. become straight and perpendicular to funicle. Total (projected) length of rhabdosome at least 120 mm. Width varies from 4 mm. proximally to 7 mm. distally. Whole frond presents long, narrow nearly rectangular outline. Stipes vary from 0.8 mm. proximally to 2 mm. distally. Funicle 1.6 mm. long and 0.5 mm. wide; enclosing funicle area is a subrectangular central disc 4 mm. long and 2 mm. wide. Thecae prominent, quite curved distally, inclined

at 40 -50° and number 9 in 10 mm. Apertural margins concave, form pronounced acute angles with thecal axes, as result, thecae distinctly pointed.

Discussion This very large specimen agrees with the holotype in the following respects (1) the overall shape and outline of the rhabdosome, (2) width of stipes, (3) thecal angle, and (4) shape of thecae and apertural margins. It differs however, in the number of thecae and in the length of the funicle. This preponderance of data favours specific designation to T.approximatus.
Type Locality Levis Shale, Levis, Quebec.

Tetragraptus kindlei Ruedemann

Plate 3 ,figure 7

1947 Tetragraptus kindlei Ruedemann (partim), G.S.A. Mem.19, p.306, pl.50, figs. 6-7.

Horizon and Locality Locality L47-930-1030, Road River, Yukon Terr., in uppermost zone of Lower Ordovician (zone of Diplograptus dentatus).

Description Regarding funicle (1.6 mm. long and 0.4 mm. wide) as vertical, four stipes, two above and two below diverge outwards from it at about 90°. Stipes straight or flexuous, varying in width from 0.5 to 0.9 mm. Thecae straight, pointed, 1.5 mm. long, four times as long as wide, overlap one half, number 9 in 10 mm. and inclined at 25°. All thecae face "upwards". Apertural margins straight, perpendicular to axes of thecae.

Discussion This specimen resembles the holotype in all respects so that the writer has little hesitation in assigning it to T.kindlei. At locality R16-4020 in the Upper Canyon of the Peel River is a specimen which resembles the holotype closely in outline, shape

and dimensions of rhabdosome, but differs in having a greater number of thecae (10-11 in 10 mm.), and a lower inclination of thecae (15-20°). The specimen is rather poorly preserved making identification difficult. It occurs, in the same horizon as the Tremadoc Staurograptus dichotomous, which is much below the quoted range of the species. It is therefore with much hesitation assigned to this species.

Type locality Glenogle shale, Glenogle, B.C.

Tetragraptus lavalensis Ruedemann

Plate 3, figure 8; Plate 4, figure 4

1935 Tetragraptus lavalensis Ruedemann, Naturaliste Canadien, vol.62, p.12, pl.1, fig.5.

1947 Tetragraptus lavalensis Ruedemann, G.S.A. Mem.19, p.313, pl.52, figs.13-16.

Horizon and Locality Locality RL6-4520, Upper Canyon of Peel River, Yukon Terr., in zone of Didymograptus bifidus (Lower Ordovician).

Description Frond consists of four simple undivided stipes 20 mm. long, arranged bilaterally. Two stipes diverge sharply and at an increasing angle from each end of funicle, and within very short distance become nearly horizontal and subparallel. Sicular represented by slight circular depression in centre of the funicle. Funicle 1.8 mm. long and 0.5 mm. wide. Stipes straight and rigid, and vary in width from 0.6 mm. proximally to 1.5 mm. distally. Distance between stipes at distal end 6 mm. Thecae curved upwards, well defined, with marked wall, number 11 in 10 mm., about three times as long as wide, inclined at 30°, angle increasing somewhat distally, and overlap one half their length.

Apertural margins somewhat concave, with development of short mucrons, nearly perpendicular to axes of thecae.

Discussion This species appears to be quite abundant. Except for very slight differences, such as the length of the funicle, and the less mucronate nature of the thecae, ~~this species~~ ^{it} is almost identical with the holotype. The writer therefore has little hesitation in calling it Tetragraptus lavalensis. Occuring at the same locality is a very similar form but differing in the number of thecae (9 in 10 mm.), and in that stipes converge somewhat distally. The latter could be caused by compression and/or its mode of preservation. Since the outline of the thecae corresponds to those of Tetragraptus lavalensis the difference in the number is regarded as minor when compared to the overall dimensions. It is therefore regarded as the same species. Two other specimens occur at localities R16-4400, the Upper Canyon of the Peel, and L44-600, the Lower Canyon of the Peel.

Type Section Lewis Shale, Quebec.

Tetragraptus pendens Elles

Plate 3 ,figures 3,5

1898 Tetragraptus pendens Elles, Geol.Soc.London, Quart.Jour.,vol.54
p.491, fig.13.

1901-1918 Tetragraptus pendens Elles. Elles and Wood, Mon.Brit.Grapt.,
p.63, pl.6, fig.3a.

1904 Tetragraptus pendens Elles. Ruedemann, N.Y.State Mus., Mem.7,
p.653, text fig.55, pl.11, figs.17-20.

1947 Tetragraptus pendens Elles. Ruedemann, G.S.A., Mem.19,p.306, pl.51
figs.18-21.

Horizon and Locality Locality R12-75, Tributary of Road River, Yukon Terr., in zone of Diplograptus dentatus (uppermost Lower Ordovician).

Description Rhabdosome bell shaped. Two primary stipes diverge initially downwards from sicula at 60° , but tend to become subparallel distally. Secondary stipes grow downward from second theca of each primary stipe, forming a four stiped pendent form. Stipes long, curved, increase in width from 0.5 mm. to 0.7 mm. in a short distance, thereafter of uniform width. Thecae simple, straight, 1.5 mm. long, overlap only slightly proximally to one third to one half distally, three times as long as wide, inclined at $20-25^{\circ}$ and number 11 in 10 mm. Apertural margins slightly curved, forming acute angles with thecal axes.

Discussion The pendent, bell shaped outline of this specimen, along with the thin stipe and number of thecae distinguishes this ~~form~~ ^{species} immediately. This species also occurs at Locality R11-1150, the Road River Tributary.

Type Locality Arenig, Middle Skiddaw shales, Great Britain.

Tetragraptus putillus (?) Ruedemann

Plate 3 , figure 14

1947 Tetragraptus putillus Ruedemann, G.S.A. Mem.19,p.314,pl.52, fig.7-12.

Horizon and Locality Locality L44-600, Lower Canyon of Peel River, Yukon, in zone of Didymograptus bifidus (Lower Ordovician).

Description Frond 8 mm. long and 5 mm. wide, consists of four simple undivided stipes arranged bilaterally, two growing from each

end of funicle. Stipes of constant width of 0.6 mm. diverge from funicle at about 130° , and gradually curve until nearly perpendicular to funicle. Funicle 1.5 mm. long and 0.5 mm. wide. Thecae simple, not distinct, ~~thecal walls~~ straight, overlap one third to one half their length, three times as long as wide, inclined at 20° and apparently number 10 in 10 mm.

Apertural margins straight, nearly perpendicular to thecal axes.

Discussion This specimen is almost like the holotype, except the number of thecae appears to be proportionately fewer. The specimen, ~~however~~ is poorly preserved so that more thecae may be present than is apparent. The author therefore assigns it to Tetragraptus putillus .

Type Locality Deepkill shale, Harrisburg, Pennsylvania.

Tetragraptus quadribrachiatus (Hall)

Plate 3 , figures 2,6,11.

1865 Graptolithus quadribrachiatus Hall, G.S.C., dec.2,p.91,pl.5, figs.1-5;pl.6, figs.5,6.

1902 Tetragraptus quadribrachiatus (Hall). Elles and Wood, Mon.Brit. Grapt. p.57, pl.5, figs.1a-d.

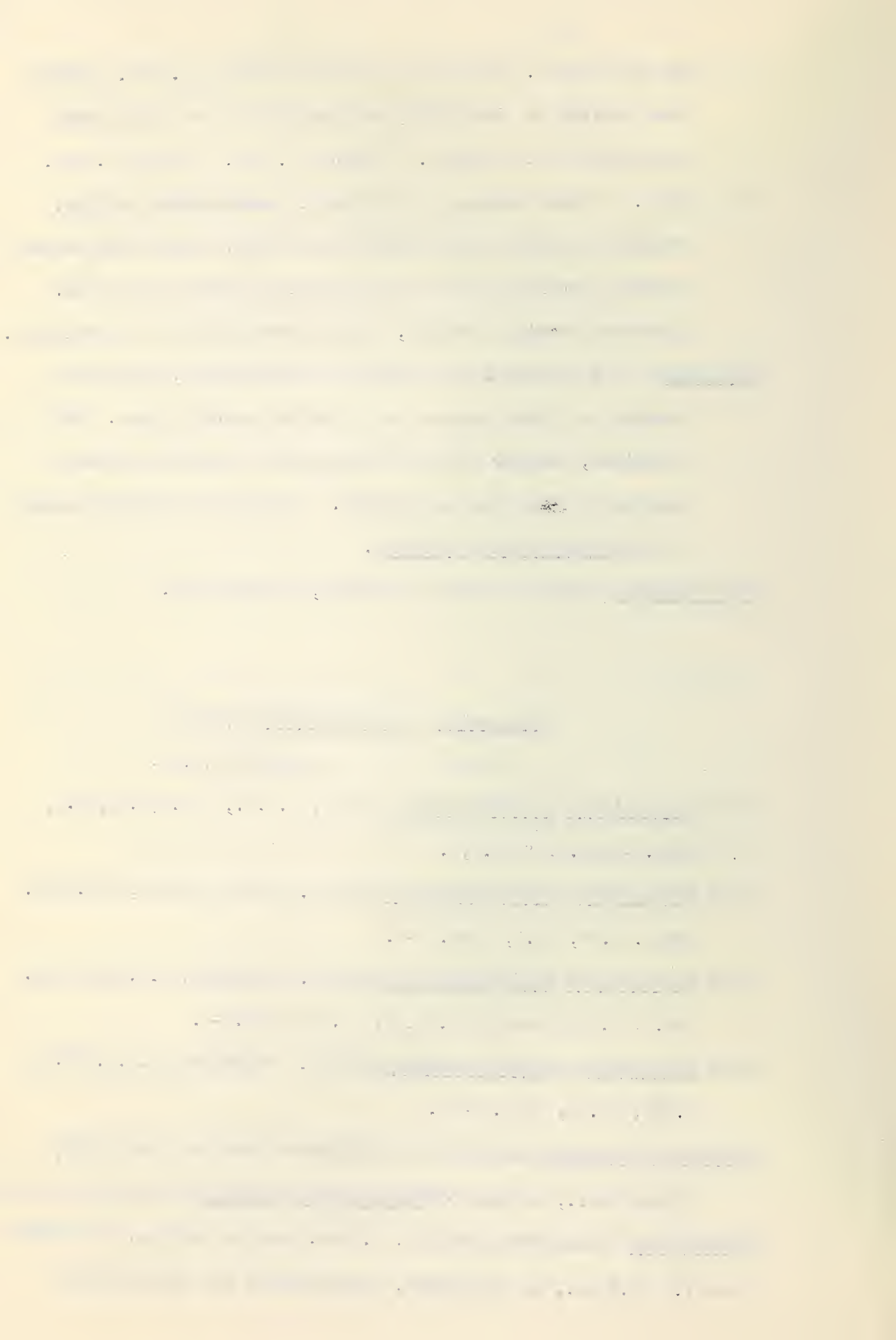
1904 Tetragraptus quadribrachiatus (Hall). Ruedemann, N.Y.State Mus., Mem.7, p.645, text, fig.51,52, pl.11, figs.1-4.

1947 Tetragraptus quadribrachiatus (Hall). Ruedemann, G.S.A.Mem.19, p.307, pl.50, figs.15-18.

Horizon and Locality Locality L44-300, Lower Canyon of Peel River,

Yukon Terr., in zone of Clonograptus flexilis (Lower Ordovician).

Description Considering funicle, 1.6 mm. long as average, but varies from 1.5 -2.6 mm., as horizontal, four straight (or occasionally



curved) stipes of variable length, two from each end of funicle, diverge about 90° to one another. Maximum length of single stipe observed, 50 mm.; width gradually increases distally from proximal 0.5 mm. All stipes in ~~scalariform~~ view, so that true width cannot be measured. Thecae preserved as thin lines on stipes, and number 8-10 in 10 mm.

Discussion This species is the most abundant fossil found in the area.

Its wide range, however, makes it useless as a zone fossil. The diagnostic shape of the frond and the distal increase in width of stipes makes it easily recognizable. It also occurs at Localities L44-600; L44-500-525; L44-440, the Lower Canyon of the Peel; R18-8910, "Ede" Creek; K73-719, "Janey" River; and R16-4303, the Upper Canyon of the Peel.

Type Locality Levis Shale, Quebec.

Tetragraptus scandens var curvatus Ruedemann

Plate 4, figure 2

1947 Tetragraptus scandens Ruedemann var. curvatus Ruedemann, G.S.A.

Mem.19,p.315, pl.52, fig.25.

Horizon and Locality Locality R16-4520, Upper Canyon of the Peel River, Yukon Terr., in zone of Didymograptus bifidus (Lower Ordovician).

Description Funicle 2 mm. long, and 0.5 mm. wide with depressionⁱⁿ centre marking sicula. Secondary stipes diverge outwards from funicle, initially at 110° , then at increasing angles they become straight distally and diverge at constant angle. Width of stipes varies from 0.8 mm. proximally to 1.5 mm. distally. Total length of rhabdosome, 40 mm. Thecae simple, distinct, slightly curved, three times as long as wide, overlap one third their length,

number 8 or 9 in 10 mm., and inclined at 20° . Apertural margins nearly straight, form obtuse angle with thecal axes.

Discussion This is the only specimen of this species found. It corresponds to the holotype in nearly every respect except for the length of the funicle (2 mm. as opposed to 3 mm. in the holotype). This however, is considered insignificant and the writer has little hesitation in assigning it to Tetragraptus scandens var. curvatus.

Type Locality St. Pauls' Limestone, St. Pauls' Inlet, Nfld.

Genus PHYLLOGRAPTUS

Phyllograptus angustifolius Hall

Plate 5 , figures 37, 38

1858 Phyllograptus angustifolius Hall, G.S.C., Rept. for 1857, 1858, p. 139.

1902 Phyllograptus angustifolius Hall. Elles and Wood, Mon. Brit. Grapt. p. 100, pl. 13, figs. 7a-f.

1904 Phyllograptus angustifolius Hall. Ruedemann, N.Y. State Mus., Mem. 7, p. 711, text fig. 37, pl. 15, figs. 31-34.

1947 Phyllograptus angustifolius Hall. Ruedemann, G.S.A. Mem. 19, p. 315, pl. 53, figs. 2-6.

Horizon and Locality Locality R12-75, Tributary to Road River, Yukon

Terr., zone of Diplograptus dentatus . (uppermost Lower Ordovician).

Description Rhabdosome subelliptical, almost leaf shaped, 17 mm. long, 6 mm. wide at the widest point (including thecal spines), with proximal and distal ends sharply rounded. Medial portion of rhabdosome has wide (1 mm.) obscure line throughout length, apparently front view of "vertical" stipe. Thecae well developed

with thick walls, slightly curved outwards, nearly all subhorizontal, except distal quarter, where they finally become subparallel to axis of rhabdosome, overlap throughout and number 11-13 in 10 mm. Longest thecae (including mucrons) 2.5 mm. Apertural margins concave, forming acute angles with thecal walls. Lower ends protracted into mucrons.

Discussion The outline of the rhabdosome, and the number of thecae are diagnostic of this species.

Type Locality Levis Shale, Quebec.

Phyllograptus sp., cf. P. angustifolius var. magnificus Ruedemann.

Plate 5 , figure 33

1947 Phyllograptus angustifolius (Hall) var. magnificus Ruedemann, G.S.A.

Mem.19,p.316, pl.53, fig.7; pl.90, fig.20

Horizon and Locality Locality R11-1150, Tributary of Road River, Yukon Terr., zone of Diplograptus dentatus . (uppermost Lower Ordovician).

Description Rhabdosome incomplete, at least 15 mm. long, greatest width 4 mm. decreasing distally to 3 mm. Thick nemacaulus throughout length. Thecae 3 mm. long, narrow, three times as long as wide, overlap one half to two thirds, inclined at 30° and number 9-10 in 10 mm. Thecae develop distinct though short spines, all directed obliquely outward. Apertural margins straight, perpendicular to declined to axis of rhabdosome.

Discussion This specimen differs from the holotype in the less declined apertural margins, and in the number of thecae. Too little is preserved to permit positive identification.

Type Locality Blakeley sandstone, Arkansas .

Phyllograptus anna mut. longus Ruedemann

Plate 5 , figure 34

1926 Phyllograptus anna Hall. mut. longus Ruedemann in Walker, G.S.C.,
Mem. 148, p.27

1947 Phyllograptus anna Hall mut. longus Ruedemann, G.S.A. Mem.19, p.317,
pl.53, figs. 36-40.

Horizon and Locality Locality L44-600, Lower Canyon of Peel River, Yukon
Terr., approximately equivalent to Didymograptus bifidus zone of
Deepkill (upper Lower Ordovician).

Description Rhabdosome compact, subelliptical, 10 mm. long, and 5mm.
wide at widest point, central portion thick. Sicular end rounded.
Thecae long and narrow, four times as long as wide, inclined at
40-45° throughout most of length of rhabdosome, but decrease to
15-20° at distal end, and number 14-15 in 10 mm. Apertural
margins convexly curved and develop broad lips 0.7 mm. long.

Type Locality Glenogle shale, Glenogle, B.C.

Phyllograptus anna mut. ultimus Ruedemann

Plate 5 , figures 22,25

1904 Phyllograptus anna (Hall) mut. ultimus Ruedemann, N.Y.State Mus.,
Mem.7, p.715, pl.15, figs. 28-30

1947 Phyllograptus anna (Hall) mut. ultimus Ruedemann, G.S.A. Mem.19,
p.317, pl.53, figs. 33-35.

Horizon and Locality Locality L64-6165, "Ede" Creek, Yukon Terr., in
zone of Diplograptus dentatus (uppermost Lower Ordovician).

Description Rhabdosome broadly oval, small, 3-4.5 mm. long and 2.5-3 mm.
wide (excluding spines) . Proximal thecae short, very slightly declined,

becoming longer and horizontal medially. Thecae broadly curved, 0.5 mm. long, overlap completely and number 20 in 10 mm. They become increasingly inclined distally and attain maximum length at distal end. Apertural margins curved; the lower edges protracted into mucrons.

Discussion The small size, the broad oval shape and the great number of thecae immediately distinguishes this species. It is quite a widespread form and serves as a good horizon marker. It also occurs at localities R12-75 and R11-1150, the tributary to the Road River, and R19-10, the Upper Canyon of the Peel.

Type Locality Levis Shale, Quebec.

Genus DIDYMOGRAPTUS

Didymograptus cuspidatus Ruedemann

Plate 5, figures 13, 28

1904 Didymograptus cuspidatus Ruedemann, N.Y. State Mus., Mem. 7, p. 698
text fig. 90, pl. 15, figs. 8, 9.

1947 Didymograptus cuspidatus Ruedemann, G.S.A. Mem. 19, p. 330, pl. 55,
fig. 2; pl. 56, fig. 19

Horizon and Locality Locality L47-930-1030, Road River, Yukon Terr., zone of Diplograptus dentatus (uppermost Lower Ordovician).

Description Sicular. 0.8 mm. long. Stipes grow outward, apparently suborally and at different levels from sicular initially at 110° , then quickly become horizontal. They are at least 45 mm. long, narrow and somewhat flexuous and increase in width at almost imperceptible rate from 0.4 mm. proximally to 0.9 mm. distally. Thecae simple, distinct, nearly straight for first two thirds of their length, then curved upward sharply the last one third, so as to widen considerably distally. They make up fully two thirds the width of the stipe, are 1.2 mm. long, about two

times as long as wide, overlap one quarter their length, inclined at 20° proximally and 50° distally, and number 12 in 10 mm. proximally to 10 in 10 mm. distally. Apertural margins slightly convex, form acute angle with thecal walls.

Discussion This species seems to be quite abundant and well developed at this locality. The very characteristic shape and number of thecae readily serves to distinguish this species from all other Didymograptids.

Type Locality Deepkill shales, New York.

Didymograptus euodus Lapworth

Plate 5 , figures 9,10

1875 Didymograptus euodus Lapworth, Geol.Soc.London, Quart.Jour., vol.31 p.645, pl.35, figs.1a-c.

1901-1918 Didymograptus euodus Lapworth. Elles and Wood, Mon.Brit. Grapt. p.21, pl.1, figs. 10a,b.

1947 Didymograptus euodus Lapworth .Ruedemann, G.S.A. Mem.19,p.332, pl.55,figs.33-36; pl.56, figs.22-24.

Horizon and Locality Locality L44-800, Lower Canyon of Peel River, Yukon terr., in zone of Diplograptus dentatus (uppermost Lower Ordovician).

Description Stipes straight, rigid and robust, with uniform width of 2.4 mm. and maximum observed length 23 mm. Thecae nearly straight throughout length, except at aperture where they turn up into sharp, pronounced mucrons, 4-5 mm. long and about five times as long as wide, overlap one half to two thirds their length, inclined at 30° and number 8-9 in 10 mm. Apertural margins concave, accentuating mucronate nature of thecae and nearly perpendicular to thecal axes.

Discussion Although the sicular region is absent in this specimen,

the characteristic shape of the thecae and the ratio of the length to the width of the thecae serves to distinguish the species from all others.

Type Locality Lower Llandeilo, Great Britain.

Didymograptus extensus (Hall)

Plate 5, figures 6,7

1865 Graptolithus extensus Hall, G.S.C., dec.2, p.80, pl.2., figs.11-16.

1870 Didymograptus extensus (Hall). Nicholson, Ann.Mag.Nat.Hist., ser.4, vol.5, p.341, pl.7, figs.2, 2a.

1901 Didymograptus extensus (Hall). Elles and Wood, Mon.Brit. Grapt., p.8, text figs. 4 a-d; pl.1, figs.1a,b.

1904 Didymograptus extensus (Hall). Ruedemann, N.Y.State Mus., Mem.7 p.668, text figs. 62-65, pl.13, figs.17,18; pl.14, figs.1-4.

1947 Didymograptus extensus (Hall). Ruedemann, G.S.A. Mem.19, p.331, p.55, fig.16; pl.56, figs.1,2.

Horizon and Locality Locality L47-930-1030, Road River, Yukon, in zone of Diplograptus dentatus (uppermost Lower Ordovician).

Description Only portions of two separate stipes, one 47 mm. the other 55 mm. long remain. Stipes straight, rigid and vary somewhat in width from 1.8-2.1. mm. Thecae simple, pronounced and nearly straight, with a slight distal curve and quite distinctly pointed, 2-2.5 mm. in length, three times as long as wide, overlap one half their length, inclined at 40° and number 9-10 in 10 mm. Apertural margins concave, form angles slightly less than right angles to the thecal axes, thereby accentuating pointed nature of thecae.

Discussion The characteristic shape of the thecae distinguishes this species from all others except D. euodus. It can be readily distinguished from the latter however by the ratio of length

to width of thecae. At this same locality and at the following L44-500, L44-600, the Lower Canyon of the Peel; and R12-2 the Road River tributary, are specimens which resemble this species in every respect except for the inclination of thecae. It should, however, be pointed out that the thecal angle is affected by compression and the mode of preservation. These specimens are therefore identified as Didymograptus sp., cf. D. extensus

Type Locality Levis Shale, Quebec.

Didymograptus extenuatus (Hall)

Plate 5 , figures 8,16

1865 Graptolithus extenuatus Hall, G.S.C., dec.2, p.75, pl.1, figs.21,22

1896 Didymograptus extenuatus (Hall). Gurley, Jour.Geol., vol.4, p.96

1947 Didymograptus extenuatus (Hall). Ruedemann, G.S.A. Mem.19, p.331, pl.56, figs.3,4.

Horizon and Locality Locality R19-10, Upper Canyon of Peel River, Yukon Terr., in zone of Diplograptus dentatus. (upper Lower Ordovician).

Description Only portion of stipe 26 mm. long and with uniform width of 1 mm. ^{remains.} Thecae simple, very slightly curved upwards, widen slightly distally, 1.5 mm. long, overlap one half to three fifths, three to four times as long as wide, inclined at 20°, and number 10 in 10 mm. Apertural margins slightly concave, form acute angles with axes of thecae, nearly perpendicular to axis of stipe, develop small mucrons.

Discussion This specimen resembles the holotype in all respects, except for the apertural margins which do not quite form right angles to the axis of the stipe. It resembles D. nicholsoni, but differs in having a slightly lower

inclination of thecae, a different ratio of thecal length to width, and in the inclination of apertural margins. It differs from D. lörnquisti in having ~~more~~ proportionately ~~more~~ thecae.

Type Locality Levis Shale, Quebec.

Didymograptus nicholsoni Lapworth

Plate 3, figure 13; Plate 5, figure 17

1875 Didymograptus nicholsoni Lapworth, Geol.Soc.London, Quart.Jour., vol. 31, p.644, pl.33, figs. 5a-d.

1901-1918 Didymograptus nicholsoni Lapworth. Elles and Wood, Mon.Brit. Grapt., pl.27, text figs.16a-c, pl.2, figs. 4a-6.

1947 Didymograptus nicholsoni Lapworth. Ruedemann, G.S.A.Mem.19,p.338 pl.55, figs.26-28; pl.56, fig.7.

Horizon and Locality Locality L44-600, Peel River, Yukon Terr., corresponding approximately to zone Didymograptus bifidus (Lower Ordovician).

Description Sicula 1.8 mm. long. Stipes straight with uniform width of 1.mm., diverge about 170° from sicula. Thecae slightly curved, 1.6 mm. long, four times as wide, pointed, overlap one quarter, widen slightly distally, number 10 in 10 mm, and inclined at $25-30^{\circ}$. Apertural margins slightly concave, at right angles to thecal axes.

Discussion The delicate nature of the stipes, the small overlap of the thecae, their number and inclination make this species quite diagnostic. At locality L47-930-1030 on the Road River, is a specimen which resembles this species in nearly every way but differs slightly in the overlap and the inclination of the thecae. It is therefore identified as Didymograptus sp.cf., D. nicholsoni 1

Type Locality Middle and Upper Skiddaw shale, Great Britain.

Didymograptus nitidus (?) (Hall)

Plate 5 , figures 11,12

1865 Graptolithus nitidus Hall, G.S.C., dec.2, p.69, pl.1, figs.1-9.

1901 Didymograptus nitidus (Hall)!. Elles and Wood, Mon.Brit.Grapt.,
p.10, pl.1, figs.2a-c.

1904 Didymograptus nitidus (Hall). Ruedemann, N.Y.State Mus., Mem.7,
p.67, text figs.66-70, pl.13, figs.1-5, ^{pl.14,} figs.5,6.

1947 Didymograptus nitidus (Hall). Ruedemann, G.S.A. Mem.19, p.339,
pl.55, figs.11-14; pl.56, fig.21.

Horizon and Locality Locality R16-4466, Upper Canyon of Peel River,

Yukon Terr., in zone of Didymograptus beds(?) (Lower Ordovician).

Description Sicula poorly preserved, about 0.9 mm. long. Stipes short,
10 mm. long, slightly curved past horizontal, widen from 1.2 mm.
~~proximally~~ to 1.5 mm. in the distance of two thecae. Thecae
pronounced, mucronate, slightly curved upwards, 2.2 mm. long,
three times as long as wide, overlap ~~two~~ thirds their length,
inclined at 40° and number 11-12 in 10 mm. Apertural margins
curved, accentuating pointed nature of thecae, and nearly
perpendicular to thecal axes.

Discussion The length of this specimen is very short compared to that
of the holotype. It shows no distal widening of the stipes
and differs slightly in the length of the sicula. The
latter, however, is partly obscured.

Type Locality Levis Shale, Quebec.

Genus ISOGRAPTUS

Isograptus caduceus (Salter)

Plate 5 , figures 19,26

- 1853 Didymograptus caduceus Salter, (pars), Geol.Soc.London, Quart.
Jour.vol.9,p.87, fig.1a.
- 1892 Isograptus gibberulus Moberg, Geol.Fören.Stockholm, Förh.,Bd.14,
p.346, pl.8, figs.3-7.
- 1904 Didymograptus (Isograptus) gibberulus (Moberg). Ruedemann,
N.Y.State, Mus., Mem.7, p.693, text.fig.89,pl.15, figs.6,7.
- 1936 Isograptus caduceus (Salter)Monsen, Nork.Geol.Tidsskr.,Bd.16,
p.153.
- 1947 Isograptus caduceus (Salter). Ruedemann, G.S.A.Mem.19,p.350,
pl.67, fig.10-44

Horizon and Locality Locality L44-800, Lower Canyon of Peel River,
Yukon Terr., in zone equivalent to Diplograptus dentatus
zone of Deepkill (uppermost Lower Ordovician).

Description Sicula 2.5 mm. long, with long nema. First thecae grow
downward subapically from the sicula, later ones gradually
fan out, forming a rounded V-shaped rhabdosome. Stipes vary
in width from 2 mm. proximally to 1 mm. in the distance of
four thecae, thereafter maintaining constant width. Thecae
slightly curved, in contact throughout, ^{vary} in length from 1.5 mm.
proximally to 1.2 mm. distally, two to three times as long as
wide, inclined at 40-45° distally and number 12-13 in 10 mm.
Apertural margins nearly straight, form acute angles with
thecal walls; lower ends protracted into substantial mucrons.
Proximal mucrons 1 mm. long, thin; distal mucrons 0.3 mm.long.

Discussion Several other specimens of this species occur in the same
horizon and show variations in the proximal and distal width of
the stipes and in the number of thecae. They are, however,

sufficiently alike to be considered the same species.

Type locality Arenig, Middle Skiddaw, Great Britain.

Isograptus caduceus mut. nanus Ruedemann

Plate 5, figure 21

1904 Didymograptus caduceus (Salter) mut. nanus Ruedemann, N.Y. State Mus., Mem. 7, p. 698, text fig. 90.

1926 Didymograptus (Isograptus) caduceus (Salter) mut. nana Ruedemann. Clark, Can. Field Nat., vol. 40, p. 137.

1947 Isograptus caduceus (Salter) mut. nanus Ruedemann, G.S.A. Mem. 19 p. 351, pl. 57, figs. 17-19.

Horizon and Locality Locality R11-1150, Tributary of Road River, Yukon Terr., in zone of Diplograptus dentatus (uppermost Lower Ordovician).

Discussion The general shape and outline of the rhabdosome is like that of I. caduceus. It differs from that species in the following respects: the proximal portion of stipe is very wide, 4 mm., then thins very rapidly within a short distance to 0.6 mm. The inclination, shape, and length of the thecae is similar to I. caduceus, but, number 15 in 10 mm. This species is immediately distinguished by the wide proximal and thinner distal portions of the stipe, and by the very rapid thinning of the stipes. At locality R16-3740 in the Upper Canyon of the Peel, is a specimen which is poorly preserved but is identified as Isograptus sp., cf. I. caduceus mut. nanus.

Type Locality Deepkill Shale, New York.

Isograptus caduceus var. A

Plate 5 , figures 23, 24

Horizon and locality Locality R11-1150, tributary of Road River, Yukon Terr., in zone of Diplograptus dentatus (uppermost Lower Ordovician).

Description General outline like that of Isograptus caduceus . Sicula 1.6 mm. long and 0.5 mm. wide. Stipes diverge at 270° . Proximal stipes 1.1 mm. wide, distal ones 0.9 mm. wide. Thecae slightly curved, three times as long as wide, in contact throughout inclined at $40-45^{\circ}$ distally and number more than 20 in 10 mm. Apertural margins curved, lower ends protracted into narrow, pronounced spines 0.5 mm. long proximally, and 0.3 mm. distally.

Discussion This specimen, differs from all other described variants in the number of thecae, the very narrow proximal part of the stipe, and the short sicula. At locality K73-1480-1560 on "Janey" River is a specimen which resembles this variant in all respects.

Isograptus forcipiformis(Ruedemann).

Plate 5 , figure 14

1904 Didymograptus forcipiformis Ruedemann, N.Y. State Mus., Mem.7, p.699, text fig.91, pl.15, figs.10-13.

1939 Isograptus forcipiformis (Ruedemann). Keble and Benson, Nat.Mus. Melbourne, Mem.11, p.83.

1947 Isograptus forcipiformis (Ruedemann), G.S.A.Mem.19, p.352, pl.57, figs. 37-40.

Horizon and Locality Locality L47-930-1030, Road River, Yukon Terr., in zone of Diplograptus dentatus (uppermost Lower Ordovician).

Description Sicular 3.6 mm. long, and narrow, with thin nema.

Growing out and bending upwards from sicular are two branches which once past the level of the sicular, become subparallel, and continue upwards to form an elongate U-shape rhabdosome. Stipes gradually thin from 1.6 mm. proximally to 1.3 mm. distally, forming a total visible length of 10 mm. Thecae broad and curved, in contact throughout, 2.5 mm. long proximally, 1.7 mm. long distally, three times as long as wide, inclined at 45°, and number 10 in 10 mm. They possess relatively short, broad spines 0.3-0.4 mm. long. Apertural margins curved, the lower ends being protracted into short spines.

Discussion This species is readily distinguished by its U-shape, the long subparallel nature of stipes and by the number of thecae.

Type section Deepkill formation, New York.

Genus novum cf. Isograptus Moberg

Plate 5, figures 15, 20

Horizon and Locality Locality R12-30, tributary of Road River, Yukon Terr., in zone of Diplograptus dentatus (uppermost Lower Ordovician).

Description Sicular 2.2 mm. long, and narrow. Thecae spread outwards from it in fanlike pattern giving definite valentine shape to rhabdosome. Rhabdosome 6 mm. long and 5 mm. wide. Free ends of stipes project only slightly above level of sicular. Distal notch 1 mm. deep. Thecae mucronate, overlap throughout length, slightly curved, of uniform length of 2 mm., three times as long as wide, inclined at 45° medially, decreasing to 30° at distal end, and number 15-16 in 10 mm. Lower part of apertural margins straight, upper portions protracted into very stout mucrons 0.3 mm. long which may be straight, or

curved slightly downward.

Discussion The very marked valentine shaped rhabdosome along with the unusual feature of the upper part of thecae forming mucrons is extremely diagnostic, making it impossible to confuse with any other graptolite. The last feature separates this specimen from the genus Isograptus.

At locality L47-930-1030 in the Road River, are two specimens which are as above but differ slightly in the number of thecae (16-18 in 10 mm.). These are exceptionally well preserved specimens, showing growth lines on thecae and are considered the same species.

Genus CRYPTOGRAPTUS

Cryptograptus antennarius (Hall)

Plate 5 , figure 36

1865 Climacograptus antennarius Hall, G.S.C. dec.2, p.112, pl.13, figs. 11-13.

1904 Climacograptus ? antennarius (Hall). Ruedemann, N.Y.State Mus., Mem7, p.731, pl.16, figs. 21-26.

1880 Cryptograptus ? antennarius (Hall). Lapworth, Ann.Mag.Nat. Hist., ser.5, vol.5, p.174.

1901-1918 Cryptograptus ? antennarius (Hall). Elles and Wood, Mon.Brit. Grapt., p.300, pl.32, figs.14a-e.

1904 Diplograptus laxus Ruedemann, N.Y.State Mus. Mem.7, p.722, pl.16, figs. 1-10.

1892 Cryptograptus antennarius (Hall). Gurley, Geol.Surv.Ark., vol. 3, p.415.

1947 Cryptograptus antennarius (Hall). Ruedemann, G.S.A. Mem.19, p.444, pl.76, figs.1-18.

Horizon and Locality Locality L47-930-1030, Road River, Yukon

Terr., in zone of Diplograptus dentatus (uppermost Lower Ordovician).

Description Rhabdosome generally small, 12 or more mm. long, and of nearly uniform width of 1.3-2.2 mm., the width varying with different specimens. Proximal end with three short, closely set, subparallel spines. Thin distinct nemacaulus present throughout length of rhabdosome. Thecae very noticeably alternate on opposite sides of rhabdosome because of wide inter-theca/spaces, giving asymmetric appearance. They are curved outwards sharply pointed, inclined at 20-30°, the angle increasing distally, 0.9 mm. long, overlap one third to one quarter, and number 12 in 10 mm. Apertural margins concave, and form acute angles with thecal axes.

Discussion The general outline and shape of this specimen, almost exactly matches Ruedemanns' (1904) description of Diplograptus laxus. In his 1947 description, he placed it with Cryptograptus antennarius, giving no reason for doing so. From Plate 76, figure 15 of the above publication, however, it is obvious that the difference is merely in the mode of preservation, as he figures a specimen possessing the antennarius aspect proximally, and the laxus aspect distally. This species occurs at several localities, and because of its easily recognizable form, is an excellent horizon marker. The species is found at localities R11-1150, Road River tributary; L64-6165, "Ede" Creek; R12-75, Road River tributary; and R16-3740, Upper Canyon of Peel River.

Type Locality Levis Shale, Quebec.

Genus GLOSSOGRAPTUS

Glossograptus ciliatus Emmons var.A

Plate 5 , figure 30

Horizon and Locality Locality L47-930-1030, Road River, Yukon Terr., in zone of Diplograptus dentatus . (uppermost Lower Ordovician).

Description Rhabdosome elliptical, 10 mm. long, 3.5 mm. wide including spines, and 2 mm. wide excluding spines. Very thick nema extends beyond rhabdosome. Thecae well developed, curved outward distally, with development of 1.3 mm. long, thick, nearly straight spines . Spines declined proximally, horizontal medially and reclined distally. Thecae inclined at 30° , overlap one half and number 18 in 10 mm. Rarely is there more than one spine per theca. Apertural margins curved, declined at 140° to axis of rhabdosome.

Discussion This specimen resembles the holotype Glossograptus ciliatus in most respects, but differ greatly in the number of thecae. This difference is considered sufficient to warrant the status of a variation.

Type Locality Deepkill Shale, New York.

Glossograptus horridus (?)Ruedemann

Plate 5 , figures 18,27

1908 Glossograptus ciliatus Emmons mut.horridus Ruedemann, N.Y.State Mus., Mem.11,p.383, pl.26, figs.8,9,pl.27,fig.5.

1947 Glossograptus horridus Ruedemann, G.S.A. Mem.19, p.451, pl.77, figs.17-22.

Horizon and Locality Locality R12-75, tributary to Road River, Yukon Terr., zone of Diplograptus dentatus.(uppermost Lower Ordovician).

Description Rhabdosome incomplete, over 10 mm. long, 1.6-2.5 mm.wide. Walls almost smooth with thecae projecting only very slightly.

Crisscrossing rhabdosome, sometimes without order are numerous very long (5 mm.) sinuous, slender spines which project from any part of thecae. Central portion of rhabdosome without structure. Proximal end rounded, with three closely set diverging spines. Thecae about 11 in 10 mm., nearly parallel to axis of rhabdosome, and develop very small sharp lips, which quickly develop into thin long spines. Apertural margins straight, small to almost non-existent.

Discussion This specimen resembles the holotype closely and is identified by its long spines with their haphazard arrangement. Because all the rhabdosome is not present, positive identification is difficult.

Type Locality Summit, Nevada .

Genus DICRANOGRAPTUS

Dicranograptus sp. cf. D. spinifer Lapworth

Plate 6, figure I

1882 Dicranograptus spinifer Lapworth, Geol. Soc. London, Quart. Jour., vol. 38, p. 610.

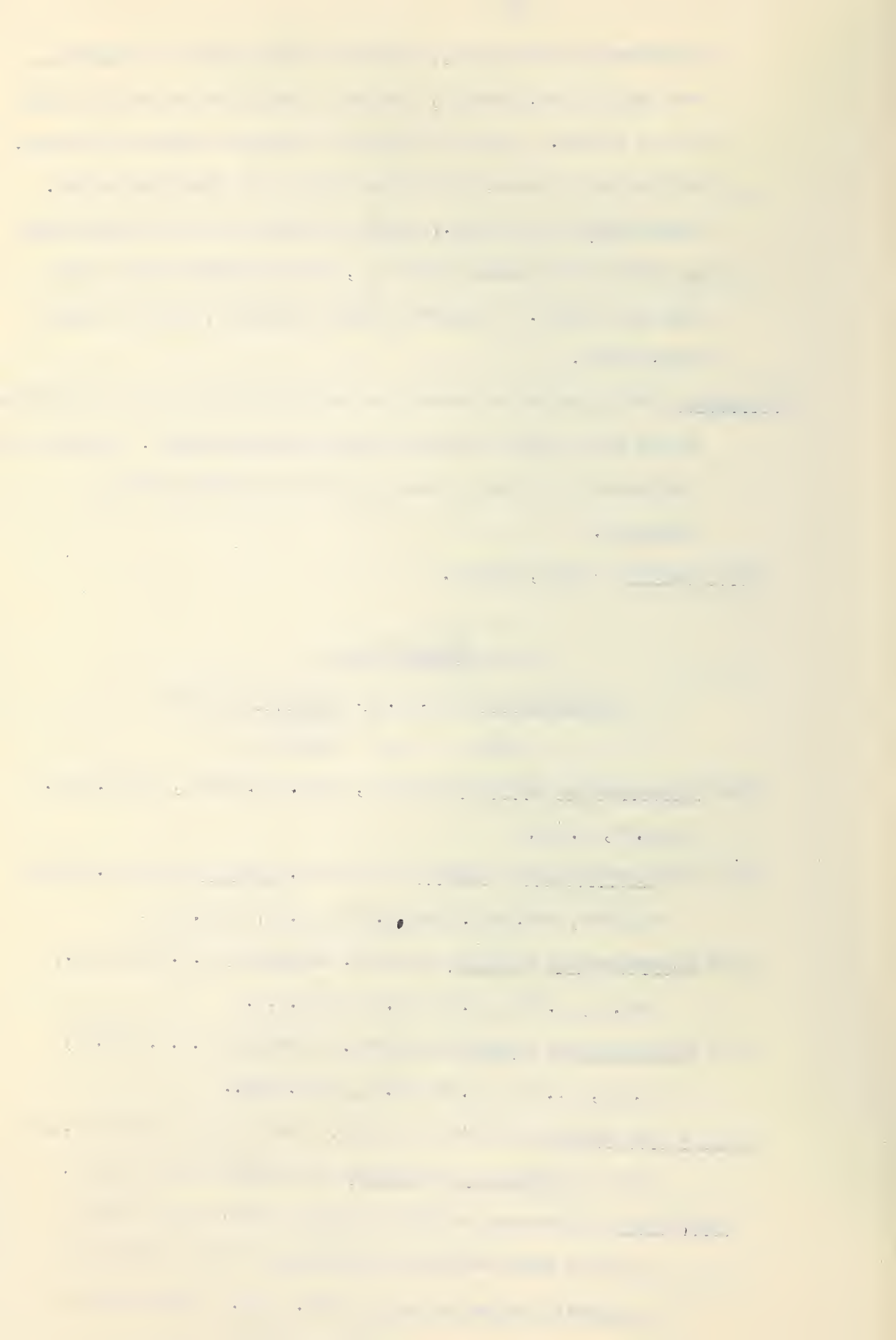
1901-1918 Dicranograptus ramosus (Hall) var. spinifer Lapworth. Elles and Wood, Mon. Brit. Grapt., p. 176, pl. 24, figs. 8a-c.

1908 Dicranograptus spinifer Lapworth, Ruedemann, N.Y. State Mus., Mem. 11, p. 330, pl. 22; pl. 23, figs. 2, 3.

1947 Dicranograptus spinifer Lapworth. Ruedemann, G.S.A. Mem. 19, p. 396, pl. 66, fig. 25; pl. 67, figs. 20-24.

Horizon and Locality Locality L64-6045, "Ede" Creek, Yukon Terr., in zone of Nemagraptus gracilis (lower Middle Ordovician).

Description Rhabdosome consists of lower 20 mm. long biserial portion which divides by dichotomy at 10° to form two uniserial stipes at least 25 mm. long. Both portions



straight and rigid, and of uniform width of 1 mm. Thecae poorly preserved. In biserial portion they are mucronate, spiniferous, number 8 in 10 mm. and alternate on opposite side of stipe. Those on uniserial portion are simple, curved outward distally, 1.3 mm. long, overlap one quarter, two to three times as long as wide, inclined at 30° , and number 7-8 in 10 mm. Apertural margins of thecae of uniserial portion slightly sigmoidal, perpendicular to axis of stipe.

Discussion Because of the poorly preserved nature^{of} the thecae of the biserial portion positive identification is impossible. The great length of the rhabdosome, with the long biserial portion, ~~however~~, is characteristic of D. spinifer.

Type Locality Glenkiln shale, Lower Hartfell shale, Great Britain.

Genus CLIMACOGRAPTUS

Climacograptus bicornis (Hall)

Plate 6 •, figure 15

1847 Graptolithus bicornis Hall, Pal.N.Y., vol.1, p.268, pl.73, figs.2a-s

1865 Climacograptus bicornis Hall, G.S.C., dec.2, p.112, pl.A. figs.1a-c.

1906 Climacograptus bicornis (Hall). Elles and Wood, Mon.Brit.Grapt., p.193, text fig.126, pl.26, figs.8a-f.

1947 Climacograptus bicornis (Hall). Ruedemann, G.S.A. Mem.19, p.425 pl.72, figs.44-52.

Horizon and Locality Locality R19-275, Upper Canyon of Peel River, Yukon Terr., approximately equivalent to zone of Glossograptus quadrimucronatus cornutus (Middle Ordovician).

Description An excellently and beautifully preserved specimen.

Rhabdosome 32 mm. in length, width varies from 0.5 mm. proximally to 1.4 mm. within two thirds its length, thereafter of uniform width. Two stout spines one from each side of proximal end of

of rhabdosome. Proximal and distal ends of thecal free edges square. Apertural margins form distinct, horizontal U-shaped excavations, one half length of thecae and one quarter width of rhabdosome.

Discussion The two stout basal spines, the number of thecae and the distal widening serve to readily distinguish the species. The simple horizontal U-shaped apertures without any other features, are most characteristic of the species.

Type Locality Normanskill Shale, New York.

Climacograptus brevis Elles and Wood

Plate 6 , figures 2,8,9.

1885 Cl.cf. minutus Marr and Roberts, Geol.Soc.London, Quart. Jour., vol.41, p.476.

1901-1918 Climacograptus brevis Elles and Wood, Mon.Brit. Grapt.,p.192 pl.27, figs.2a-f.

1945 Cl.brevis Elles and Wood. Waterlot, Service Géologique, p.49, tableau 4, p.49, fig.97.

Horizon and Locality Locality L64-5150 "Ede" Creek, Yukon Terr., in zone of Dicranograptus nicholsoni (?) (Upper Ordovician).

Description Rhabdosome small, 9-11 mm. in length, width nearly uniform at 0.8-0.9 mm. Proximal and distal ends rounded, the former possessing thin virgella. Thin nemacaulus present throughout length, extending beyond as nema. Thecal ventral margins straight square, slightly inclined to axis of rhabdosome. Thecae somewhat sigmoidal, 0.5 mm. long and number 14-11 in 10 mm. Apertures small, nearly horizontal, one quarter width of rhabdosome and one quarter length of ventral margins of thecae.

Discussion This specimen resembles the holotype in nearly all respects and is characterized by its minuteness, narrowness and number of

thecae.

Type Locality Llandeilo Flags, Great Britain.

Climacograptus sp.,cf. C.latus Elles and Wood

Plate 6 , figures 10,11

1901-1918 Climacograptus latus Elles and Wood, Mon.Brit.Grapt.,p.209,
pl.27, figs.3a-h.

1945 Climacograptus latus Elles and Wood. Waterlot, Service Géologique,
tableau 7, p.52, fig.122.

Horizon and Locality Locality L64-5150, "Ede" Creek, Yukon Terr., in
zone of Dicranograptus nicholsoni (?) (Upper Ordovician).

Description Rhabsodome short, 11 mm. in length, width increased
steadily and rapidly from 0.6 mm. proximally to 1.6 mm.
distally. Thin nemacaulus present throughout length, extends
beyond to form nema. ~~Proximal end rounded.~~ Thecal ventral
margins parallel to axis of rhabdosome, proximal two thirds
being distinctly curved, and near origin become almost parallel
to axis of rhabdosome. Proximal part of ventral margins
rounded, distal ends square. Thecae 1 mm. long, overlap one
quarter and number 10 in 10 mm. Apertures large, nearly
horizontal, U-shaped to subelliptical excavations, width about
one third length of free edges of thecae, depth one third width
of rhabdosome at proximal end, and one quarter at distal end.
Introverted, curved, finger shaped depression continues short
distance beyond aperture, becoming almost parallel to axis of
rhabdosome.

Discussion The very rapid widening is characteristic of this species.
This specimen agrees with the holotype in shape and number of
thecae, but differs in the length of the rhabdosome. It occurs
at a somewhat lower horizon than quoted by Elles and Wood

(1901-1918).

Type Locality Upper Hartfell shales, Upper Caradoc, Great Britain.

Climacograptus tridentatus var. maximus Decker

Plate 6 , figure 13

1847 Climacograptus bicornis Hall, Pal.N.Y., vol.1,p.268,pl.73,fig.2

1876 Climacograptus bicornis (Hall) var. tridentatus Lapworth, Cat.

West. Scott. Foss., pl.2, fig.52.

1901-1918 Climacograptus bicornis (Hall) var. tridentatus Lapworth.

Elles and Wood, Mon.Brit.Grapt., p.195, pl.26, figs.9a-c.

1935 Climacograptus tridentatus Lapworth var. maximus Decker, Jour.

Pal.vol. 9, p.707, figs. 1p-t, 2a-d.

1947 Climacograptus tridentatus Lapworth var. maximus Decker. Ruedemann

G.S.A. Mem.19, p.439, pl.75, figs. 16-26.

Horizon and Locality Locality K73-2080, "Janey" River, Yukon Terr.,

exact zone unknown, but Upper Ordovician.

Description Rhabdosome very robust, broken, but at least 30 mm. in

length, width increases gradually from 1.1 mm. proximally to 3 mm. distally. Three stout, slightly curved spines grow down and out from sicular end, attaining length of 6 mm. Thecae inclined slighly to axis of rhabdosome proximally, but become parallel distally in typical Climacograptid fashion, develop ^{overlap} lips, one third and number 11 in 10 mm. proximally, decreasing to 9 in 10 mm. distally. Apertures long narrow, U-shaped excavations, occupying fully one third width of rhabdosome.

Discussion This species has the appearance of much oversized C. bicornis,

but differs in having three stout spines.

Type Locality Sylvan shale, Oklahoma.

Climacograptus sp.A

Plate 6 , figures 5-7

Horizon and Locality Locality K73-1480-1560, "Janey" River, Yukon Terr.,
in zone of Diplograptus dentatus (uppermost Lower Ordovician).

Description Rhabdosome fairly robust, widens gradually throughout or for most of length to maximum of 2 mm., and attains length of at least 30 mm. Proximal end bluntly rounded with three short spines, composed of one virgella and two spines. Float attached directly to distal end of rhabdosome. Thecae parallel to axis of rhabdosome, overlap one third, 1.5 mm. long, and number 12-9 in 10 mm. Proximal end of ventral margins rounded while distal ends square. Apertures wide, horizontal, U-shaped excavations occupying one third length of ventral margin of thecae, and one quarter to one sixth width of rhabdosome. Continuing beyond apertures are very pronounced, introverted finger shaped depressions which curve downward, almost to centre of rhabdosome. This feature appears persistent and constant.

Discussion The general outline of the rhabdosome, the shape of the apertures and the number of thecae is similar to C. bicornis, but the peculiar introverted depression beyond the aperture is common to no other species and serves to readily distinguish it. This species is found at two other localities; R11-1150, in the Road River tributary, and R16-3740 in the Upper Canyon of the Peel, and agree in nearly all respects with the above specimen.

Genus DIPLOGRAPTUS

Diplograptus (Glyplograptus) dentatus (?) (Brongniart)

Plate 6 , figures 12,14.

1828 Fucoides dentatus Brongniart, Hist.Veget.Foss., vol.1,p.70,pl.16,
figs.9-12.

1865 Diplograptus pristiniiformis Hall, G.S.,C.dec.2, p.110 ff,pl.13
figs.15-17.

1875 Diplograptus dentatus (Brongniart). Hopkinson and Lapworth, Geol.
Soc. London, Quart. Jour., vol.31, p.656, pl.34, figs.5 a-k.

1904 Diplograptus dentatus (Brongniart).Ruedemann, N.Y.State Mus.,
Mem.7, pl.719, text fig.100, pl.17, figs.10-13.

1947 Diplograptus dentatus (Brongniart).Ruedemann, G.S.A. Mem.19,
p.404, pl.68, fig.30, pl.69, figs.1-8.

Horizon and Locality Locality R16-3740, Upper Canyon of Peel River,
Yukon Terr., in zone of D.dentatus (uppermost Lower Ordovician).

Description Rhabdosome incomplete, greater than 10 mm. in length,
width apparently constant at 1.7 mm. Thin nemacaulus extends
throughout, and projects 7 mm. beyond as nema. Thecae typical
Diplograptid type, pointed, 1.4 mm. long, overlap one half, three
times as long as wide, inclined at 20° and number 12 in 10 mm.
Apertural margins straight to slightly concave, form acute angles
with thecal walls and inclined at 90-100° to axis of rhabdosome.

Discussion The overall shape of the rhabdosome, and the shape and
number of thecae match the holotype very closely, but the
incompleteness of the specimen makes positive identification
difficult. This is the only specimen of the species found
and is very important, as it occurs in this locality below beds
of known Tremadoc age, suggesting a fault somewhere within this
zone.

Type Locality Deepkill formation, New York.

1876 Diplograptus perexcavatus Lapworth, Cat. West. Scott. Foss., pl. 2
Fig. 38.

1901-1918 Diplograptus perexcavatus Lapworth. Elles and Wood, Mon. Brit.
Grapt., p. 267, pl. 31, figs. 15 a-d.

1934 Diplograptus cf. perexcavatus Lapworth. Keble and Harris, Nat.
Mus. Melbourne, Me^m 8, p. 176, pl. 21, fig. 3.

Horizon and Locality Horizon R12-75, Upper Canyon of Peel River, Yukon
Terr., in zone of Diplograptus dentatus (uppermost Lower Ordovician)

Description Rhabdosome long, robust, attains length of 40-50 mm.;

gradually increases width from 1 mm. proximally to 2-2.5 mm. in
about one-half its length, thereafter maintains constant width,
or more commonly thins gradually towards end. Proximal end
rounded to almost pointed. One stout spine 1.2-1.5 mm. long,
projects down from sicular end. Nemacaulus 0.5 mm. wide runs
throughout rhabdosome and extends 17 mm. beyond to join small
float. Thecae variable, slightly sigmoidal; proximal thecae of
Climacograptid type, while distal thecae of Diplograptid
disposition, 1.5 mm. long in mature portion, and number 15-11
in 10 mm. Apertures introverted, V-shaped excavations; width
about one third length of ventral edge of thecae, and depth one
quarter width of rhabdosome. Slight development of introverted
depression continues beyond aperture.

Discussion This specimen was with some hesitation assigned to the
genus Diplograptus, as the Diplograptus disposition of the
thecae is attained only in the distal part of the rhabdosome.
It resembles the holotype in all ways except length. The
apertural shape, with slight depressions beyond, the number of
thecae, and the distal thinning of rhabdosome is diagnostic.

In Britain it occurs in the Middle Ordovician, but is quoted by Keble and Harris (1934) as coming from the Lower Ordovician in Australia, in a zone equivalent to the Diplograptus dentatus zone (uppermost Lower Ordovician). In this area, it also occurs at this lower horizon.

Type Locality Glenkiln, Lower Hartfell (lower Middle Ordovician), Great Britain.

Diplograptus (Glyptograptus) sp., cf. D. teretiusculus var. siccatus Elles and Wood

Plate 6 , figures 18, 19

1901-1918 Diplograptus teretiusculus (Hisinger) var. siccatus Elles and Wood, Mon. Brit. Grapt., p. 253, pl. 31, figs. 3a-d.

Horizon and Locality Locality R12-2, tributary of Road River, Yukon Terr., in zone of Nemagraptus gracilis (lower Middle Ordovician).

Description Rhabdosome small, 9 mm. in length, and varies in width from 0.8 mm. proximally to 1.1 mm. distally. Proximal end rounded, with long, narrow spine. Thin straight nemacaulus apparently present throughout length and projects some distance beyond rhabdosome. Thecae subparallel to axis of rhabdosome, sigmoidal, overlap only slightly, 0.8 mm. long and number 13-14 in 10 mm.; free edge convex; proximal edge of ventral wall gently rounded, while distal end sharply rounded. Apertures deep, broad, introverted, elongate U-shaped excavations inclined at 60° to axis of rhabdosome, width one third length of ventral margins of thecae and depth one third to one quarter width of rhabdosome.

Discussion The small size of the rhabdosome, the very introverted nature of apertures, and the sigmoidal and rounded features of thecae are diagnostic.

Type locality Llandeilo, Great Britain.

Diplograptus sp., cf. D. tamariscus var. incertus Elles and Wood

Plate 7 , figures 4,9.

1876 Diplograptus hughesi Lapworth, Cat. West. Scott. Foss., pl. 2, fig. 37.

1901-1918 Diplograptus tamariscus (Nicholson) var. incertus Elles and Wood, Mon. Brit. Grapt., p. 249, pl. 30, figs. 9a-d.

Horizon and Locality Locality R19-585, Upper Canyon of Peel River, Yukon Terr., in zone of M. convolutus (upper Lower Silurian).

Description Rhabdosome small, straight, rigid, only 8 mm. in length, and width increases from proximal 0.8 mm. to distal 1.5 mm.

Proximal end rounded, with three tiny spines. Thecae show growth rings, sigmoidal, inclined at low angle of 10-15°, 1.5 mm. long, overlap one half, and number 13-11 in 10 mm. Free walls of thecae straight to convex, except near apertures of preceding thecae where they curve inward. Apertural margins straight, nearly horizontal, and curved near contacts with next thecae.

Discussion This specimen resembles the holotype in the gradual widening and shape of the rhabdosome, and the shape and number of thecae. It differs in being much shorter, but it is apparent that the specimen is incomplete and hence was originally longer.

Type locality Llandovery, Great Britain.

Diplograptus sp., cf., D. truncatus var. intermedius Elles and Wood

Plate 6 , figures 16, 17

1901-1918 Diplograptus truncatus Lapworth var. intermedius Elles and

Wood, Mon. Brit. Grapt., p. 236, pl. 29, figs. 4a-e.

Horizon and Locality Locality L64-5150, "Ede" Creek, Yukon Terr., in zone of Dicranograptus nicholsoni (?) (Upper Ordovician).

Description Rhabdosome robust, 30 mm. in length, and of constant width of 2.5 mm. Thin straight nemacaulus throughout, which extends beyond as nema. Proximal end obscure, appears enclosed in sac-like development. Thecae inclined to subparallel, depending on nature of preservation, inclined up to 20° to axis of rhabdosome, sharply pointed, straight to sigmoidal, overlap one third to one half, and number 9-12 in 10 mm. Apertural margins straight to slightly concave, sometimes sigmoidal, nearly perpendicular to axis of rhabdosome.

Discussion Although the number of thecae varies slightly from the holotype, their shape seems very characteristic. The specimen appears broken off at the distal end, so total length is unknown.

Type Locality Lower Harffell shales, Great Britain.

Diplograptus (Glyptograptus) verpertinus(?) Ruedemann

Plate 6 , figures 3,4

1847 Diplograptus pristis Hall(pars), Pal.N.Y., vol.1, pl.72, figs.1, 1a, b, k, l.

1908 Diplograptus foliaceus (Murchison) mut. verspertinus Ruedemann, N.Y. State Mus., Mem.11, p.352, text.figs.296-298, pl.25, figs.4, 5, 18.

1947 Diplograptus verspertinus Ruedemann, G.S.A. Mem.19, p.410, pl.69, figs.62-68.

Horizon and Locality Locality RL9-275, Upper Canyon of Peel River, Yukon Terr., in zone of Glossograptus quadrimucronatus cornutus (Middle Ordovician).

Description Distal portion of rhabdosome absent. Observed length 16 mm., width varies fairly rapidly from 1 mm. proximally to 3 mm. distally, the rate of widening decreasing distally. Proximal end sharply rounded. Thecae sharply sigmoidal with straight mucronate ventral margins, 1.5-2 mm. long, 14-12 in 10 mm. overlap one half, inclined at 30°, angle appears to increase distally. Apertural margins slightly concave to straight, perpendicular to axis of rhabdosome.

Discussion Except for being slightly wider, this specimen resembles the holotype very closely. The shape of the thecae is particularly diagnostic and distinguishes it from all other Diplograptids, except D.foliaceous . It occurs with Climacograptus bicornis.

Type Locality Canajoharie Shale, Hudson Valley, New York

Genus PETALOGRAPTUS

Petalograptus palmeus var. tenuis (?) (Barrande)

Plate 7 , figures 6, 12

1850 Graptolithus palmeus (Barrande) var. tenuis Barrande, Grapt. de Bohême, p. 61, pl. 3, figs. 1, 2.

1901-1918 Petalograptus palmeus (Barrande) var. tenuis (Barrande). Elles and Wood, Mon. Brit. Grapt., p. 276, pl. 32, figs. 3a-d.

Horizon and Locality Locality 147-2070, Road River, Yukon Terr., zone of Monograptus turriculatus (lower Middle Silurian).

Description Rhabdosome elongate, leaf shaped, 5 mm. in length with maximum width of 1.5 mm. Proximal portion of rhabdosome V-shaped for about one half length, thereafter constant width; antiscular end broadly rounded. Thin virgula present throughout, and extends beyond as a nema. Thecae simple, straight, and vary in length from 0.6 mm. in proximal end to maximum length of 1 mm. distally, two times as long as wide, overlap one third, inclined at 30-35°, and apparently number 13 in 10 mm. Apertural margins straight, perpendicular to thecal axes.

Discussion The specimen matches the holotype closely, but, because of its poorly preserved nature, positive identification is not possible.

Type Locality Upper Birkhill and Lower Gala, Great Britain.

Genus TRIGONOGRAPTUS

Trigonograptus ensiformis (Hall)

Plate 5 , figures 31,32

1865 Retiolites ensiformis Hall, G.S.C., dec.2, p.114, pl.14, figs.1-51901-1918 Trigonograptus ensiformis (Hall). Elles and Wood, Mon.Brit.

Grapt., pl.302, text figs.202 a-c, pl.35, figs.1a-c.

1904 Trigonograptus ensiformis (Hall). Ruedemann, N.Y.State Mus., Mem.7,
p.727, pl.17, figs.1-9.1947 Trigonograptus ensiformis (Hall). Ruedemann, G.S.A. Mem.19, p.447,
pl. 76, figs.49-57.Horizon and Locality Locality L44-800, Lower Canyon of Peel River,
Yukon Terr., in zone of Diplograptus dentatus (uppermost Lower
Ordovician).Description Rhabdosome broad, lanceolate, over 30 mm. long; widens
rapidly at first from narrow proximal end to 3 mm. in distance
of 15 mm., thereafter maintains constant width to near distal
end, where it thins gradually, resulting in an elongate leaf
shaped rhabdosome. Outer wall of rhabdosome completely smooth.
Proximal end abruptly terminated and without spine. Thecae
about three times as long as wide, inclined at 45° , 11-10 in
10 mm., and separated by wide interthecal spaces, giving the
impression of thick thecal walls. Apertural margins straight,
flush, and parallel to axis of rhabdosome.Discussion The characteristic shape of the rhabdosome, the shape of
the thecae and interthecal areas, distinguish this species
from all other graptolites. This species is extremely abundant
at the above locality, but was not found elsewhere.Type Locality Levis Shale, Levis, Quebec.

Genus LASIOGRAPTUS

Lasiograptus (Halograptus) echinatus (Ruedemann)

Plate 5 , figures 29, 35.

1904 Glossograptus echinatus Ruedemann, N.Y.State Mus., Mem.7, p.726, text fig.102, pl.16, figs.30-32.

1947 Lasiograptus echinatus Ruedemann, G.S.A. Mem.19, p.462, pl.77, figs. 9-14, 16.

Horizon and Locality Locality L44-800, Lower Canyon of Peel River, Mukon Terr., in zone of Diplograptus dentatus (uppermost Lower Ordovician).

Description Rhabdosome elongate about 22 mm. long, elliptical, very spinose, with spines 1.5 mm. long. Greatest width 5.5 mm. including spines, and 3 mm. excluding spines. Proximal end rounded, with two short spines. Central portion obscure, but distal end contains two virgulae, one running down either side of rhabdosome, which distally fuse to form nema. Thecae curve outwards, overlap one half, about 2 mm. long, inclined at 15°, number 11-12 in 10 mm., and develop long spines. Lacinia formed by few spines, on one side of rhabdosome.

Discussion The presence of a lacinia is characteristic of all

Lasiograptids, and except for its presence, the above specimen would be called Glossograptus. That Glossograptids gave rise to Lasiograptids seems a natural conclusion. This species is subject to great variation as is shown in another specimen from the same locality and zone. Here, all the spines distally develop into a beautiful and complete lacinia. At locality L64-6165 on "Ede" Creek is a specimen which resembles the above, but, differs in apparently having a greater number of thecae.

This is identified as Lasiograptus sp., cf. L. echinatus.

Type locality Deepkill Shale, New York.

Retiolites geinitzianus Barrande

Plate 7 , figures 1-3

1850 (Gladiolites) Retiolites geinitzianus Barrande, Grapt.de Bohême
p.69, pl.4, figs.16-33.

1901-1918 Retiolites geinitzianus Barrande, Elles and Wood, Mon.Brit.
Grapt.,p.336, text figs.220 a-f, pl.34,figs. 8a-d.

1947 Retiolites geinitzianus Barrande. Ruedemann, G.S.A. Mem.19,p.466,
pl.83, figs.1,2.

Horizon and Locality Locality L64-5020, "Ede" Creek, Yukon Terr., in
zone of Monograptus convolutus (upper Lower Silurian).

Description Rhabdosome file shaped, at least 45 mm. in length, width
varies from 2 mm. proximally to 6 mm. (including mucrons) in
about one half length, thereafter of uniform width. Well developed
nemacaulus present throughout, Thecae slightly curved outwards,
inclined at 50°, develop mucrons 0.5 mm. long, 3 mm. long, 0.7 mm.
wide, in contact throughout and numbering 14-9 in 10 mm. Clathria
apparently straight to zig-zag. Reticula, with subrectangular
to polygonal mesh, covers all of thecae. Apertural margins
straight, and at right angles to thecal axes; lower ends develop
into pointed somewhat declined mucrons.

Discussion Only two specimens of R.geinitzianus were found. Both
show the mucronate nature of the thecae. The characteristic
shape of the thecae and rhabdosome, and the net like reticula
distinguishes the species.

Type locality Gala-Tarannon and Lower Wenlock shales, Great Britain.

Retiolites sp., cf. R. perlatus Nicholson

Plate 7 , figure 11

1868 Retiolites perlatus Nicholson, Geol. Soc. London, Quart. Jour., vol. 24, p. 530, pl. 19, figs. 21, 22.

1901-1918 Retiolites perlatus Nicholson. Elles and Wood, Mon. Brit. Grapt., p. 338, pl. 34, figs. 10a-f.

Horizon and Locality Locality L44-1800, Lower Canyon of Peel River, Yukon Terr., in zone of Monograptus convolutus (upper Lower Silurian).

Description Only net-like reticula and walls between thecae preserved. Rhabdosome 10 mm. long, and varies in width from a proximal 2 mm. to a distal 4 mm. Extension of thecal walls form spines on basal parts of thecae. Thecae straight, inclined at 50° , three times as long as wide, and number 13 in 10 mm.

Discussion In spite of the fragmentary nature of the specimen, the net-like reticula, and the number of thecae are very characteristic of this species. It differs from R. geinitzianus in having a greater number of thecae, a poorly developed clathria, and less distinct thecal walls.

Type Locality Llandovery, Birkhill, Great Britain.

Retiolites perlatus var. daironi Lapworth

Plate 7 , figures 5,14

1877 Retiolites perlatus Nicholson var. Daironi ^{Lapworth} Grapt. co. Down, Pro.
Belfast Nat. Field Club, p.136, pl.6, fig.30.

1901-1918 Retiolites perlatus Nicholson var. Daironi (Lapworth) Elles
and Wood, Mon. Brit. Grapt. p.340, pl.34, fig.11.

Horizon and Locality Locality R19-585, Upper Canyon of Peel River,
Yukon Terr., zone of Monograptus turriculatus (lowermost
Middle Silurian).

Description Rhabdosome at least 30 mm. in length, width varies quite
rapidly within first 15 mm. from 1.5 mm. proximally to 6.5 mm.
distally, thereafter of uniform width. Very thin nemacaulus
throughout length. Thecal walls indistinctly defined.
Thecae membranous, in contact or separated distally, show
occasional growth lines, inclined at 60° to axis of rhabdosome,
4.5 mm. long, and 0.7 mm. wide and number 12-9 in 10 mm. Aper-
tural margins convex, and form angles of 60° with thecal
walls. Reticula delicate and fibrous, covering whole of thecae,
with subrectangular to very irregular shaped meshes.

Discussion The very characteristic shape and number of the thecae,
with the mesh like network, serve to distinguish this
species.

Type locality Birkhill shales, Great Britain.

Genus MONOGRAPTUS

Monograptus sp., cf. M. communis Lapworth

Plate 7 , figure 20

1876 Monograptus convolutus (Hisinger) var. communis Lapworth, Geol. Mag., ser. 2, vol. 3, p. 358, pl. 13, figs. 4a, b.

1918 Monograptus communis Lapworth. Elles and Wood, Mon. Brit. Grapt., p. 480, pl. 49, figs. 1a-c.

1947 Monograptus communis Lapworth. Ruedemann, G.S.A. Mem. 19, p. 477, pl. 86, figs. 42, 43.

Horizon and Locality Locality R19-585, Upper Canyon of Peel River, Yukon Terr., in zone of Monograptus convolutus (upper Lower Silurian).

Description Rhabdosome fish-hook-shaped, 30 mm. long, varies in width from 0.5 mm. proximally to 1.5 mm. distally, with proximal end tightly arcuate. Thecae 11-8 in 10 mm.; ~~and~~ in proximal end are nearly isolate, tubular, just in contact, ~~and~~ form hook, while distal thecae are triangular with distal hook and overlap one third. Free portions of thecae occupy one half width of rhabdosome.

Discussion The specimen resembles the holotype in all respects except in the number of thecae.

Type Locality Llandovery, Great Britain.

Monograptus communis Lapworth var.A

Plate 7 , figure 7

Horizon and Locality Locality K60-720, Trail River, Yukon Terr., in zone of Monograptus convolutus (uppermost Lower Silurian).

Description Ehabdosome at least 30 mm. in length, and gradually increases in width from 0.7 to 1.2 mm. It has sharp proximal dorsal curvature which becomes more gentle curve distally to form fish hook outline. Thecae triangular, 12-10 in 10 mm, narrow toward aperture, just in contact proximally to overlap one third distally, and curved upwards and back sharply so that aperture faces toward proximal end.

Discussion The specimen closely resembles the holotype of M. communis , but differs in the somewhat thinner nature and greater number of thecae. The fish hook shape of the rhabdosome, and the nearly isolate proximal thecae with increasing distal overlap are particularly diagnostic of this species.

Monograptus convolutus (Hisinger)

Plate 7 , figures 16,22

1837 Prionodus convolutus Hisinger, Lethaea Suecia, Suppl., p.114, pl.35 fig.7.

1892 Monograptus convolutus (Hisinger).Törnquist, Lunds Univ. Arsskr., Bd.28, p.30, pl.3, fig.5-11.

1918 Monograptus convolutus (Hisinger).Elles and Wood, Mon. Brit. Grapt., pl.467, text fig.324 a-b, pl.47, figs.1a-d.

1947 Monograptus convolutus (Hisinger).Ruedemann, G.S.A. Mem.19, p.478, pl.87, figs.2-6.

Horizon and Locality Locality L44-1800, Lower Canyon of Peel River, Yukon Terr., in zone of Monograptus convolutus (upper Lower Silurian).

Description Rhabdosome planispiral, of at least two to three whorls commencing from tight inner coil. Stipe 3 mm. wide (excluding spines) in mature portion. Thecae 10 in 10 mm., triangular, just in contact, inclined slightly, very pointed, with development of very thin, hair-like spines. Proximal thecae somewhat isolate and curved; distal thecae just in contact, triangular, nearly perpendicular to axis of stipe. Free portion of thecae occupies three quarters width of branch.

Discussion The spiral form of the rhabdosome, and the triangular spinose nature, and number of thecae distinguishes this from all other Monograptids. At locality K74-384 on "Janey" River, is a specimen, which except for a slight variation in the number of thecae, corresponds almost exactly to the above description. This species has been reported from the South Nahanni River, Northwest Territories, by Ruedemann in Cameron (1938).

Type Locality Llandovery, Great Britain.

Monograptus convolutus (Hisinger) var. A

Plate 7 , figure 21

Horizon and Locality Locality L64-5020, "Ede" Creek, Yukon Terr., in zone of Monograptus turriculatus (lower Middle Silurian).

Description Rhabdosome formed of a widening planispiral coil. Primary spiral 4 mm. in diameter, last whorl 20 mm. Width of stipe varies from 1 mm. proximally to 3 mm. distally. Thin but prominent virgula seen throughout rhabdosome. Thecae variable; proximal thecae simple, retroverted tubes, whose free portion occupies two thirds width of rhabdosome; distal thecae triangular, elongate, slightly curved, with very pronounced spines, occupy three quarters width of stipe, almost at right angles to axis of stipe, and number 15-14 in 10 mm.

Discussion The specimen resembles the holotype of M. convolutus, but differs in having proportionately nearly twice as many thecae. This variation is found in a horizon equivalent to M. turriculatus in the Middle Silurian, two zones above the M. convolutus zone of Great Britain.

Monograptus sp., cf. M. crenularis Lapworth

Plate 9, figures 5, 14

1880 Monograptus crenularis Lapworth, Ann. Mag. Nat. Hist., vol. 5, p. 153, pl. 4, figs. 10 a-c.

1901-1918 Monograptus crenularis Lapworth. Elles and Wood, Mon. Brit. Grapt., p. 414, pl. 41, figs. 7a-e.

Horizon and Locality Locality K74-384, "Janey" River, Yukon Terr., in zone of Monograptus convolutus (upper Lower Silurian).

Description Rhabdosome straight, at least 30 mm. long; width very gradually and imperceptibly increases to 1 mm. Proximal portion of thecae straight, distal portion distinctly sigmoidal. Free edges straight to convex, inclined slightly to axis of rhabdosome. Thecae 3 mm. long, overlap two thirds, six times as long as wide, inclined at 20° , and number 8-9 in 10 mm. Tilted U-shaped excavations to gentle depressions lie between thecae. Apertural margins concave.

Discussion This specimen differs from the holotype only in the number of thecae. The slender straight rhabdosome with sigmoidal thecae separated by distinct excavations is quite diagnostic.

Type Locality Llandovery Shale, Great Britain.

Monograptus sp., cf. M. crinitus Wood

Plate 7 , figures 8, 19

1900 Monograptus crinitus Wood, Geol. Soc. London, Quart. Jour., vol. 56,
p. 480, text figs. 23 a-d, pl. 25, figs. 26 a-b.

1901-1918 Monograptus crinitus Wood. Elles and Wood, Mon. Brit. Grapt.
p. 435, text fig. 298 a-c, pl. 44, figs. 3 a-c.

Horizon and Locality Locality K83-0-260; Hart River, Yukon Terr., in
zone of Monograptus nilssoni (upper Middle Silurian).

Description Rhabdosome very thin, 0.2 mm. wide, delicate and arcuate,
with ventral curvature. Thecae tiny, almost isolate, inclined
at very low angle of about 5°, curved out sharply at distal
end to form tiny hook, and number 10-12 in 10 mm.

Discussion The specimen resembles the holotype in the shape of the
rhabdosome and thecae, and in its very delicate nature. It
differs, however, in having a greater number of thecae and in
being thinner. It is very similar to M. crinitus var. exilis
Decker, but differs in having more thecae.

Type locality Lower Ludlow shales, Great Britain.

Monograptus sp., cf. M. delicatulus Tornquist

Plate 8 , figures 5, 15

1901-1918 Monograptus delicatulus Elles and Wood, Mon. Brit. Grapt., p. 478
pl. 47, figs. 2 a, b.

Horizon and Locality Locality L44-1800, Lower Canyon of Peel River,
Yukon Terr., in zone of Monograptus convolutus (upper Lower
Silurian).

Description Rhabdosome small, incomplete, at least 10 mm. in length,
with very arcuate dorsal curvature, and varies very slightly
from 0.5 mm. to 0.6 mm. in width. Proximal thecae isolate;
distal thecae thicker, and just in contact number 12 in 10 mm.

curve upward from low inclination, ^{with} curvature increasing distally, and distal one third turned back sharply so that aperture points obliquely backward. Projecting from lips of apertures are spines perpendicular to axis of rhabdosome.

Discussion This specimen resembles M. delicatulus in the general shape and size of the rhabdosome, in the shape of thecae and in the feature of distal thecae becoming more in contact. It differs, however, in the possession of apertural spines.

Type locality Llandovery shales, Great Britain.

Monograptus exiguus (Nicholson)

Plate , figures

1868 Graptolites lobiferous (M'Coy) var. exiguus Nicholson, Geol. Soc.

London, Quart. Jour., vol. 24, p. 533, pl. 19 figs. 27, 28.

1901-1918 Monograptus exiguus (Nicholson). Elles and Wood, Mon. Brit.

Grapt. p. 453, pl. 46, figs. 1a-d.

Horizon and Locality Locality L47-2070, Road River, Yukon Terr., in zone of Monograptus turriculatus (lower Middle Silurian).

Description Very tiny rhabdosome with pronounced fish hook shape, and varies in width from 0.3 to 0.5 mm. Sicula long (1 mm.) in comparison with rhabdosome. Thecae very tiny, 0.7 mm. long, 13-15 in 10 mm., just barely in contact, initially inclined at low angle, and curved upwards with distal one third reflexed back and around sharply to form complete lobe.

Discussion The very minute size of the rhabdosome and the lobe-like thecae distinguishes this species from all others. At locality L64-5020 on "Ede" Creek is a specimen which agrees with the above description in all details.

Type Locality Gala-Tarannon beds, Great Britain.

Monograptus gemmatus (Barrande)

Plate 8 , figures 2,10

1850 Rastrites gemmatus Barrande, Grapt.de Bohême, p.68, pl.4, fig.51901-1918 Monograptus gemmatus (Barrande).Elles and Wood, Mon.Brit.

Grapt., p.436, pl.43, figs. 5 a-c.

Horizon and Locality Locality K74-384, "Janey" River, Yukon Terr.,in zone of Monograptus convolutus (upper Lower Silurian).Description Rhabdosome very thin, 0.2-0.5 mm. wide, straw-like, with slight ventral curvature. Thecae tiny node-like hooks on stipe, number 7-9 in 10 mm. and completely isolate.Discussion The very minute nature of the rhabdosome with the isolated node-like thecae distinguish this species.Type Locality Llandovery shales, Great Britain.Monograptus sp., cf. M. gotlandicus Perner

Plate 8 , figures 3,4

1890 Monograptus sp. Holm, Gotlands Graptolitier, p.18, pl.1, figs.27-30.1899 Monograptus gotlandicus Perner, Etude sur les Graptolites de Bohême, pt.3, sect.8, p.12, pl.14, fig.22.1901-1918 Monograptus gotlandicus Perner. Elles and Wood, Mon.Brit. Grapt., p.382, pl.37, fig.8.Horizon and Locality Locality R20-119, Hart River, Yukon Terr., in of Monograptus nilssoni (upper Middle Silurian).Description Rhabdosome straight, at least 30 mm. in length, with slight proximal ventral curve, and width increasing from 0.5 mm. proximally to 1.5 mm. distally. Thecae simple, straight or nearly so, narrowing distally, 3 mm. long in mature part, overlap one half in proximal end to two thirds in distal end, four times as long as wide, and number 10-8

in 10 mm. Apertural margins slightly concave and form obtuse angles with thecal walls.

Discussion The distal thinning of the thecae is diagnostic of this species. It differs, however, from the holotype in having slightly fewer thecae, and in being somewhat thinner.

Type Locality Lower Ludlow shales, Great Britain.

Monograptus sp., cf. M. halli (Barrande)

Plate , figure

1850 Graptolithus halli, Barrande, Grapt.de. Bohême, p.48, pl. 2, figs. 12, 13

1901-1918 Monograptus halli (Barrande) . Elles and Wood, Mon.Brit. Grapt., p.443, pl.44, figs.8 a-f.

Horizon and Locality Locality L47-2070, Road River, Yukon Terr., in zone of Monograptus turriculatus (lower Middle Silurian).

Description Rhabdosome incomplete, 25 mm. in length, apparently straight or only very slightly curved and of uniform width of 1.5 mm. Thecae inclined at low angle initially, curve outwards steadily and last one third recurved back fairly sharply, resulting in apertures facing obliquely outwards towards proximal end, overlap one third to one half and number 10 in 10 mm. Recurved portion long and tube shaped. Free portions of thecae occupy one half width of stipe.

Discussion Although the shape of the rhabdosome and thecae resemble that of the holotype very well, not enough of the specimen remains to ensure positive identification.

Type locality Gala-Tarannon beds, Great Britain.

Monograptus sp., cf. M. intermedius (Carruthers)

Plate 8 , figures 6, 23

1868 Graptolithus intermedius Carruthers, Geol. Mag., vol. 6, p. 126,
pl. 5, fig. 18.

1911 Monograptus intermedius (Carruthers). Elles and Wood, Mon. Brit.
Grapt., p. 485, pl. 49, figs. 3a-c.

Horizon and Locality Locality R19-585, Upper Canyon of Peel River,
Yukon Terr., in zone of Monograptus convolutus (upper Lower
Silurian).

Description Rhabdosome small, delicate, with dorsal arcuate curvature,
at least 15 mm. in length, and gradually increases in width from
proximal 0.5 mm. to a distal 0.8 mm. or more. Thecae apparently
isolate, or just in contact, 8-10 in 10 mm., subtriangular,
and attached most of their length. They curve upwards from very
low inclination, with distal third curved back sharply to form
hook so that apertures point obliquely back. Free portions of
thecae occupy two thirds width of rhabdosome.

Discussion Although the specimen resembles the holotype in nearly all
respects, insufficient remains for positive identification. It
is distinguished by its delicate form, dorsal curvatures, and
shape and number of thecae.

Type locality Llandovery shale, Great Britain.

Monograptus sp.,cf..M.jaculum Lapworth

Plate 8 , figures 7,25

1876 Monograptus Hisingeri var.jaculum Lapworth, Geol.Mag., dec.2,
vol.3,p.351, pl.12, figs.2 a-d

1901-1918 Monograptus jaculum Lapworth. Elles and Wood, Mon.Brit.Grapt.
p.373, pl.37, figs.4 a-d.

Horizon and Locality Locality K74-384,"Janey " River, Yukon Terr., in
zone of Monograptus convolutus (upper Lower Silurian).

Description Rhabdosome slightly curved to straight, apparently widens
distally, with observed width of 1.2 mm. Thecae 9-10 in 10 mm.,
inclined at angle of 20° or less, curve upward, and outward so as
to develop distal lips, are 2 mm. long in mature portion, six
times as long as wide and overlap one third to one half.
Apertural margins straight to slightly curved, perpendicular to
axis of rhabdosome.

Type locality Llandovery shale, Great Britain.

Monograptus leptotheca(?) Lapworth

Plate 8 , figures 19,27

1876 Monograptus leptotheca Lapworth, Geol. Mag.,dec.2, vol.3, p.352
pl.12, figs.4a-e.

1901-1918 Monograptus leptotheca Lapworth. Elles and Wood, Mon.Brit.
Grapt.,p.371, pl.37, figs.2-d.

Horizon and Locality Locality L44-1800, Lower Canyon of Peel River,
Yukon Terr.,in zone of Monograptus convolutus (upper Lower
Silurian).

Description Rhabdosome straight and rigid throughout, 50 mm. long with

sicular end absent, and of nearly uniform width of 1.5 mm. Thecal free edges very slightly inclined to horizontal. Thecae long, nearly straight, inclined at 30° , narrow slightly distally, overlap three quarters, eight times as long as wide, 5 mm. long and number 9-8 in 10 mm. Apertural margins straight, perpendicular to axis of rhabdosome.

Discussion The very long, narrow, closely bunched thecae are diagnostic of this species. They are, however, somewhat shorter than those of the holotype. Since the rhabdosome of this specimen is incomplete it is quite probable that the stipe would widen distally, hence the thecae would be longer. At locality RL9-585 in the Upper Canyon of the Peel is a specimen which resembles the above very closely and is identified as M.sp., cf. M. leptotheca.

Type locality Upper Llandovery, Birkhill shales Great Britain.

Monograptus marri(?) Perner

Plate 8 , figures 9,12

1897 Monograptus marri Perner, Grapt.de Bohême, pt.3a, p.21, text
figs. 23-25, figs.5,6,10,11.

1901-1918 Monograptus marri Perner. Elles and Wood, Mon.Brit.Grapt.,
p.422, text figs.284 a,b,pl.42, figs.4a-d.

1947 Monograptus marri Perner. Ruedemann, G.S.A. Mem.19,p.482,
pl.86, figs.11-13.

Horizon and Locality Locality L64-5020, "Ede" Creek, Yukon Terr.,
in zone of Monograptus turriculatus (lowermost Middle Silurian).

Description Rhabdosome straight, quite rigid, 30 mm. in length, with width increasing gradually from a proximal 0.6 mm. to a distal 1.3 mm. Virgula fairly broad. Thecae of uniform shape throughout, inclined at low angle initially, but curve outward in a progressively tighter arc, until last one third

recurved back sharply but smoothly into a definite hook. Two thirds of theca involved in formation of hook. They tend to be S-shaped, overlap one third and number 12-10 in 10 mm. Free portion makes up one half width of rhabdosome.

Discussion This specimen resembles the holotype very closely, but differs in having a greater number of thecae.

Type locality Gala-Tarrannon beds, Great Britain.

Monograptus nilssoni (Barrande)

Plate 8, figures 16, 21; Plate 9, figure 3

1850 Graptolithus nilssoni Barrande, Grapt.de Bohême, p.51, pl.2, fig.16.

1852 Monograptus nilssoni (Barrande). Geinitz, Die Graptolithen der Grauwacken form. Sachsen, p.35, pl.2, figs.17-20, 24, 25, 28-32.

1901-1918 Monograptus nilssoni (Barrande). Elles and Wood, Mon.Brit. Grapt., p.369, pl.37, figs.1a-c.

1935 Monograptus nilssoni (Barrande). Decker, Jour.Pal., Vol.9, p.442, figs.26, 27.

1947 Monograptus nilssoni (Barrande). Ruedemann, G.S.A.Mem.19, p.482, pl.84, figs.9-12.

Horizon and Locality Locality K83-O-260, Hart River, Yukon Terr., in zone of Monograptus nilssoni (upper Middle Silurian).

Description Rhabdosome apparently incomplete, at least 30 mm. long, with fairly pronounced proximal ventral curvature, straightening out distally to become only very slightly arcuate, and widens from proximal 0.4 mm. to distal 1 mm. within 20 mm., thereafter of uniform width. Sicular straight, 1.4 mm. long. Thecae simple, sigmoidal, 1.5-2 mm. long in mature portion, overlap one sixth proximally to one third distally, four times as long as wide, inclined at 20° and number 8-10 in 10 mm. Apertural margins straight to concave, nearly perpendicular to thecal axes.

Discussion The arcuate, ventral curvature of the rhabdosome, and above all the shape of the thecae serve to distinguish this species. At locality R20-221 on the Hart River is a specimen which corresponds to the above very well.

Type Locality Lower Ludlow shale, Great Britain.

Monograptus nudus Lapworth

Plate 8 , figures 1,26

1876 Monograptus Hisingeri Lapworth, Geol.Mag.,dec.2, vol.3, p.350, pl.12, figs.1a-c.

1880 Monograptus Hisingeri Lapworth var.nudus Lapworth, Ann.Mag.Nat. Hist., vol.5, p.156, pl.4, figs.7a-c.

1901-1918 Monograptus nudus Lapworth. Elles and Wood, Mon.Brit.Grapt., p.375, pl.37, figs.6a-e.

Horizon and Locality Locality K60-720, Trail River, Yukon Terr., in zone of Monograptus convolutus (uppermost Lower Silurian).

Description Rhabdosome incomplete, straight and rigid throughout, about 35 mm. long, widening from 0.6 mm. proximally to 1.7mm. distally. Sicular broad, 1.2 mm. long. Thecae simple, slightly sigmoidal, 2.5 mm. long, overlap one half to two thirds, three to four times as long as wide, inclined at 30° and number 11-9 in 10 mm. Apertural margins straight or slightly concave, perpendicular to thecal axes.

Discussion Except for its width this specimen matches M.nudus very well. As, however, the rhabdosome widens steadily throughout all of the preserved length, there is little doubt that if it were complete, the required width of 2 mm. would be reached.

Type locality Upper Llandovery to lower Tarannon, Great Britain.

Monograptus sp., cf. M. pandus Lapworth

Plate 8 , figures 18, 20

1877 Monograptus lobiferous var. pandus Lapworth, Grapt. Co. Down, Belfast

Nat. Field Club, Proc., p. 129, pl. 6, figs. 3a-c.

1901-1918 Monograptus pandus Lapworth. Elles and Wood, Mon. Brit. Grapt.,

p. 421, text fig. 283, pl. 42, figs. 3a-d.

1947 Monograptus pandus Lapworth. Ruedemann, G.S.A. Mem. 19, p. 483, pl. 86,

figs. 1-3.

Horizon and Locality Locality L44-1800, Lower Canyon of Peel River,

Yukon Terr., in zone of Monograptus convolutus (upper Lower Silurian).

Description Rhabdosome straight and rigid throughout, at least 50 mm.

long, and widens to a maximum of 2.5 mm. Sicular end absent.

Thick, pronounced virgula throughout length. Thecae

initially straight, and inclined at 30° , but last one third

curved back somewhat sharply so that aperture points obliquely

back and out. They are very closely set, tubular, of nearly

uniform width, overlap one half, and number 12-10 in 10 mm.

Free portions of thecae occupy about one fifth width of

rhabdosome.

Discussion The shape of the thecae is very diagnostic of this species.

The specimen differs in having a greater number of thecae,

therefore, it is only tentatively identified as this species.

It apparently occurs somewhat lower than the quoted zone of

M. turriculatus, since it is found with M. convolutus in this

area.

Type locality Gala-Tarannon beds, Great Britain.

Monograptus sp., aff. M. planus (Barrande)

Plate 8 , figures 8, 17

1850 Graptolithus proteus var. planus Barrande, Grapt. de Bohême, p. 50, pl. 4, fig. 15.

1901-1918 Monograptus planus (Barrande). Elles and Wood, Mon. Brit. Grapt., p. 484, pl. 48, figs. 6a-d.

Horizon and Locality Locality L64-5020, "Ede" Creek, Yukon Terr., in zone of Monograptus turriculatus (lower Middle Silurian).

Description Rhabdosome incomplete, less than 10 mm. long, tiny and delicate with sharp dorsal curvature, and varies in width from 0.5 mm. proximally to 0.9 mm. distally. Thecae 15-12 in 10 mm., only just in contact, curve outward from stipe; distal one quarter recurved back sharply to form definite hook so that apertures face back or even obliquely inward. Free portion occupies two thirds to three quarters width of stipe.

Discussion Although the specimen resembles M. planus in width of rhabdosome and in number and general shape of thecae, not enough of the rhabdosome is present to permit positive identification. The thecae appear to occupy more of the stipe width than do those of the holotype. It is therefore with much hesitation identified as M. planus .

Type locality Gala-Tarannon beds, Great Britain.

Monograptus riccartonensis Lapworth

Plate 8 , figures 11, 24

1876 Monograptus riccartonensis Lapworth, Geol.Mag., vol.3, p.355
pl.13, figs.2a-e.

1901-1918 Monograptus riccartonensis Lapworth. Elles and Wood, Mon.
Brit.Grapt., p.424, pl.42, figs.8 a-c.

Horizon and Locality Locality L47-2359, Road River, Yukon Terr., in
zone of Monograptus riccartonensis (Middle Silurian).

Description Rhabdosome straight and rigid throughout, apparently
long, and widens to a maximum observed width of 1.9 mm. Thecae
9-10 in 10 mm., overlap one third to one half, straight and
inclined at 30° in proximal half. In distal half, recurved
back very sharply to form short pointed hook. Free portion
occupies only one quarter width of rhabdosome.

Discussion The rigidity of the rhabdosome and the pointed, sharply
recurved nature of the free portions of the thecae which
occupy such a small part of the width of the rhabdosome is
very diagnostic, and serves to distinguish even a small
fragment of this species.

Type locality Wenlock shales, Great Britain.

Monograptus spiralis (Geinitz)

Plate 9 , figure I

1842 Graptolithus spiralis Geinitz, Neues Jahrb.Min., p.700, pl.10.

1901-1918 Monograptus spiralis (Geinitz). Elles and Wood, Mon.Brit.
Grapt., p.475, text figs.331a-c, pl.48, figs.7a-d.

1947 Monograptus spiralis (Geinitz). Ruedemann, G.S.A. Mem.19, p.487,
pl.87, fig.15.

Horizon and Locality Locality R19-585, Upper Canyon of Peel River,
Yukon Terr., in zone of Monograptus turriculatus (lower
Middle Silurian).

Description Rhabdosome planispiral, of two whorls, nearly circular, with maximum width of stipes at least 1.4 mm. Thecae apparently of similar shape throughout, subtriangular, thick compared to width of rhabdosome, overlap one third and number 10-11 in 10 mm. Free portions of thecae recurved back to form almost pointed hook, and occupying nearly one half width of rhabdosome.

Discussion This specimen resembles the holotype in the shape of the rhabdosome and of thecae, and in the gradually widening of the stipes distally. It differs slightly, however, in the greater number of thecae. This difference is, however, not considered great, and it is assigned to this species with little hesitation. A specimen from locality L47-2070 on the Road River is fragmentary but otherwise like the above specimen in nearly all respects. It is therefore identified as Monograptus sp., cf. M. spiralis.

Type locality Throughout the Garannon, Great Britain.

Monograptus turriculatus (Barrande)

Plate 9 , figures 2, 13

1850 Graptolithus turriculatus Barrande, Grapt. de Boheme, p.56, pl.4, figs. 7-11.

1901-1918 Monograptus turriculatus (Barrande) Elles and Wood, Mon. Brit. Grapt., p.438, pl.44, figs.4 a-e.

Horizon and Locality Locality L64-5020, Road River, Yukon Terr., in zone of Monograptus turriculatus (lower Middle Silurian).

Description Rhabdosome small, with planispiral, helical spiral, or other shapes combining these two forms and with stipe of constant width of about 1 mm. Very thin hairlike virgula throughout length. Thecae very tiny and number 14-16 in 10 mm., overlap one quarter; are sub triangular, spiniferous, and inclined at low angle initially to rhabdosome, then curving

outward rapidly, with distal third recurved back sharply. Free portions quite thin.

Discussion The spiral shape of the rhabdosome, and the number of thecae is very characteristic of this species. At locality L47-2070 on the Road River, is a specimen whose dimensions, except for having fewer thecae, matches the above description. It is therefore identified as M.turriculatus (?)

Type Locality Lower Gala-Tarannon, Great Britain.

Monograptus sp., cf. M.ultimus Perner

Plate 9 , figures 7, 10

1899 Monograptus ultimus Perner, Etudes Grapt.de Bohême, p.3, sec.6 p.13, text figs.14a-b, pl.16, figs.4,5,11a-b.

1901-1918 Monograptus cf. ultimus Perner. Elles and Wood, Mon.Brit. Grapt.,p.383, text figs.253 a-c, pl.37, figs.14 a-d.

1935 Monograptus cf. ultimus Perner. Decker, Jour.Pal.,vol.9, p.443, fig.25.

1947 Monograptus cf. ultimus Perner. Ruedemann, G.S.A.Mem.19,p.488 pl.84, fig.35.

Horizon and Locality Locality R20-119, Hart River, Mukon Terr., in zone of Monograptus nilssoni (upper Middle Silurian).

Description Rhabdosome at least 30 mm. long, varies in width from initial 0.6 mm. to distal 1 mm. and except for proximal end, where it may show slight dorsal curve, is nearly straight. Thecae simple, slightly curved outwards distally, 1.4 mm. long, overlap not at all to one third, three times as long as wide, inclined at 30-40° , and number 12-14 in 10 mm. Apertural margins slightly concave, perpendicular to axes of thecae.

Discussion This specimen resembles the holotype in thinness of stipe,

and general shape and number of thecae, but differs in being considerably longer. Elles and Wood (1901-1918) state the length never exceeds 2 cms. In Britain this species occurs in the M.leintwardinensis zone, whereas in this area, it occurs in the M.nilssoni zone.

Type locality Lower Ludlow shales, Great Britain.

Monograptus undulatus (?) Elles and Wood

Plate 9 , figures 15,17

(?) 1850 Graptolithus becki Barrande, Grapt.de Bohême, p.50, pl.3, fig.15,
1901-1918 Monograptus undulatus Elles and Wood, Mon.Brit.Grapt.,p.432,
pl.45, fig.5.

1945 Monograptus undulatus Elles and Wood. Waterlot, Service

Géologique, No.63, p.80, tableau 35, fig.364.

Horizon and Locality Locality K74-384, "Janey" River, Yukon Terr., in
zone of Monograptus convolutus (upper Lower Silurian).

Description Rhabdosome very thin and delicate, apparently short, with
gentle dorsal curvature, and width ranging from 0.3 mm.
proximally to 0.6 mm. distally. Thecae long, narrow tubes
attached for most of their length; straight except for
distal one third which recurves sharply back to form a small
but distinct pointed hook, barely in contact, inclined at
low angle, and number 8-9 in 10 mm. Free portion occupying
two thirds width of rhabdosome.

Type locality Llandovery to Taranon (?), Great Britain.

Monograptus vomerinus (Nicholson)

Plate 9 , figures 4,16

1872 Graptolithus vomerinus Nicholson, Mon.Brit.Grapt., p.53, fig.211901-1918 Monograptus vomerinus (Nicholson).Elles and Wood, Mon.Brit.

Grapt.,p.409, text fig.275a, pl.41, figs.1a-e.

1945 Monograptus vomerinus (Nicholson). Waterlot, Service Géologique,

No.68, p.76, tableau 31, fig.322.

1947 Monograptus vomerinus (Nicholson). Ruedemann, G.S.A. Mem.19,

p.490, pl.85, figs.23-26.

Horizon and locality Locality L64-2460, "Ede"Creek, Yukon Terr., exact zone unknown, but within Wenlock shale equivalent (Middle Silurian).

Description Rhabdosome straight throughout, 23 mm. long and increases in width from initial 0.5 mm. to distal 2 mm. Virgula may continue beyond rhabdosome. Thecal free edge straight, inclined at low angle ($0-15^{\circ}$) and occupies one quarter width of rhabdosome. Thecae decidedly sigmoidal, separated by distinct pits, overlap one half, number 12-10 in 10 mm., and inclined at 25° . Apertural margins straight, perpendicular to thecal free walls.

Discussion The very characteristic shape of the thecae with defined pits separating them is very diagnostic. It is of little use as a zone fossil as it occurs through a wide range of the Middle Silurian. At locality L47-2350, on the Road River, there occurs a specimen similar to above, which is undoubtedly the same species.

Type locality Wenlock shales, Great Britain.

Monograptus vomerinus var. gracilis Elles and Wood

Plate 9 , figure 6

1900 Monograptus vomerinus (Nicholson) var. B. Elles, Geol.Soc.London,
Quart.Jour., p.405, fig.16.

1901-1918 Monograptus vomerinus (Nicholson) var. gracilis Elles and
Wood, Mon.Brit.Grapt.,p.411, pl.41, figs.3 a-d.

Horizon and Locality Locality L64-3250, "Ede" Creek, Yukon Terr., in
zone of M.riccartonensis (Middle Silurian).

Description Rhabdosome straight, rigid, 20 mm. in length, with width
increasing from initial 0.9 mm. to distal 1.5 mm. Thecae as in
holotype of M.vomerinus , but more sigmoidal, number 12-14 in
10 mm., and separated by deep excavations. Free portions of
thecae horizontal to slightly inclined and occupy one quarter
width of rhabdosome.

Type locality Wenlock Shales, Great Britain.

Monograptus vulgaris var. curtus (Wood)

Plate 9 , figures 9,12

1900 Monograptus vulgaris Wood var. B. Wood, ^{Geol. Soc. London,} ~~Geol. Soc. London, Quart. Jour.,~~
vol.56, p.457, pl.25, fig.4.

1901-1918 Monograptus vulgaris Wood var. curtus Elles and Wood, Mon.
Brit.Grapt.,p.379, pl.37, fig.11.

Horizon and Locality Locality K83-0-260, Hart River, Yukon Terr., in
zone of Monograptus nilssoni (upper Middle Silurian).

Description Rhabdosome simple, straight, with very slight proximal
curvature, at least 60 mm. long, and widens rapidly at first
from 0.6 mm. to 1.5 mm., thereafter of uniform width. Thecae
simple, curved outwards fairly strongly distally, 2 mm. long,
overlap three quarters, three times as long as wide, widen
distally, inclined at 20° proximally, increasing to 40°

distally, and number 12-9 in 10 mm. Apertural margins slightly concave, perpendicular to axes of thecae. Because of inclination of distal portion of thecae and angle of apertural margins, the two form symmetrical inverted cone.

Discussion This specimen resembles the holotype very closely. The uniform distal width, the rigidity of the rhabdosome and the shape of the thecae serve to distinguish this species.

Type Locality Lower Ludlow shales, Great Britain.

Monograptus sp. A

Plate 9 , figures 8, 11

Horizon and Locality Locality L64-2460, "Ede" Creek, Yukon Terr., exact zone unknown, but apparently of Wenlock (upper Middle Silurian), age.

Description Rhabdosome small, hook shaped, straight and rigid throughout most length, 20-30 mm. long and widens from 0.4 mm. to 1 mm. in about 5 mm. length, thereafter of uniform width. Thecae bifurcated and number 15-12 in 10 mm; proximal thecae initially inclined at low angle, curve outward and reflexed back to form hook and overlap one sixth; distal thecae lack hook and overlap one ~~third~~ third. Free portions of thecae occupy one half width of rhabdosome in proximal region, and one quarter in distal region.

Discussion This specimen most closely resembles M. difformis, but differs in the number of thecae, in the more rigid character of the distal portion of the stipe, and in the somewhat more hooked nature of the distal thecae.

Genus RASTRITES

Rastrites hybridus Lapworth

Plate 7 , figures 17,18

1876 Rastrites peregrinus Barrande var. hybridus Lapworth, Geol. Mag.,

Vol. 3, p.313, pl.10, fig.5.

1901-1918 Rastrites hybridus Lapworth. Elles and Wood, Mon. Brit. Grapt.,

p.491, pl.50, figs.4 a-f.

Horizon and Locality Locality R12-704, Road River Tributary, YukonTerr., in zone of Monograptus convolutus (Lower Silurian).Description Rhabdosome distinctly arcuate, incomplete. Stipes very thin,

0.1 mm. wide. Thecae 10 in 10 mm., 1-1.3 mm. long, isolate,

tubular, nearly perpendicular to axis of stipe with distal

end swollen by being sharply reflexed, forming a club shape.

Interthecal spaces 0.6-0.7 mm.

Discussion The number of thecae, with their club shape, and the close

interthecal spaces readily distinguish this species.

Type locality Llandovery, Great Britain.

Genus GYRTOGRAPTUS

Gyrtograptus kindlei Ruedemann var. A

Plate 7 , figure 13

Horizon and Locality Locality K83-0-260, Hart River, Yukon Terr., inzone of Monograptus nilssoni (upper Middle Silurian).Description Stipes gently curved, of variable length, thin, 0.3-0.4 mm.

wide. Secondary stipes formed by growing out of aperture of

theca of primary stipe. Two such cladia present in specimen.

Thecae simple narrow tubes, straight, inclined about 10° ,

1.5 mm. long, six times as long as wide, overlap one third

and number 6-8 in 10 mm. Apertural margins slightly concave,

perpendicular to axis of rhabdosome.

Discussion This specimen resembles the holotype of C.kindlei very closely, but differs in having far fewer thecae. It is therefore considered a new variation.

Genus LINOGRAPTUS

Linograptus phillipsi var. multiramosus Decker.

Plate 7 , figures 10,15

1935 Monograptus (Linograptus) phillipsi Decker var. multiramosus Decker,
Jour.Pal., vol.9,p.445, figs.42-43.

1947 Linograptus phillipsi Decker var. multiramosus Decker. Ruedemann,
G.S.A. Mem.19,p.492, pl.90, figs.7-9.

Horizon and Locality Locality R20-221, Hart River, Yukon Terr., in
zone of Monograptus nilssoni (upper Middle Silurian).

Description Synrhabdosome formed of myriads of thin flexuous
rhabdosomes radiating outwards in all directions from common
centre. Rhabdosome very thin, of 0.2 mm. width, and delicate.
Thecae in earlier portion nearly straight with only incipient
development of forward curvature, while distal thecae show
strong forward flexure.

Discussion The numerous very thin rhabdosomes growing out from a
common centre, and the forward flexure of distal thecae is very
diagnostic of this variation. It differs from L.phillipsi in
having far more numerous stipes. It has been previously only
reported from Oklahoma.

Type locality Henryhouse shale, Oklahoma.

FOSSIL PLATES

PLATE I

ORDOVICIAN GRAPTOLITES OF NORTHERN YUKON

- Fig.1 Dictyonema murrayi Hall; hypotype, x 2; Upper Canyon of Peel River, Yukon, Lower Ordovician.
- Fig.2 Acanthograptus sp.; hypotype x 2; Lower Ordovician, "Janey" River, Yukon.
- Fig.3 Chaunograptus sp.; hypotype, x 2; Lower Ordovician, "Janey" River, Yukon.
- Fig.4 Dictyonema robustum Hall; hypotype x 2; Lower Ordovician, Lower Canyon of Peel River, Yukon.
- Fig.5 Dictyonema flabelliforme (Eichwald); hypotype x 2; Lower Ordovician, Trail River, Yukon.
- Fig.6 Dendrograptus sp., aff. D. fruticosus Hall; hypotype x 2; Lower Ordovician, Trail River, Yukon.
- Fig.7 Dendrograptus sp., cf. D. thomasi Ruedemann; hypotype x 2; Lower Ordovician, Trail River, Yukon.
- Fig.8 Dictyonema quadriangulare Hall; hypotype x 2; Lower Ordovician, Lower Canyon of Peel River, Yukon.

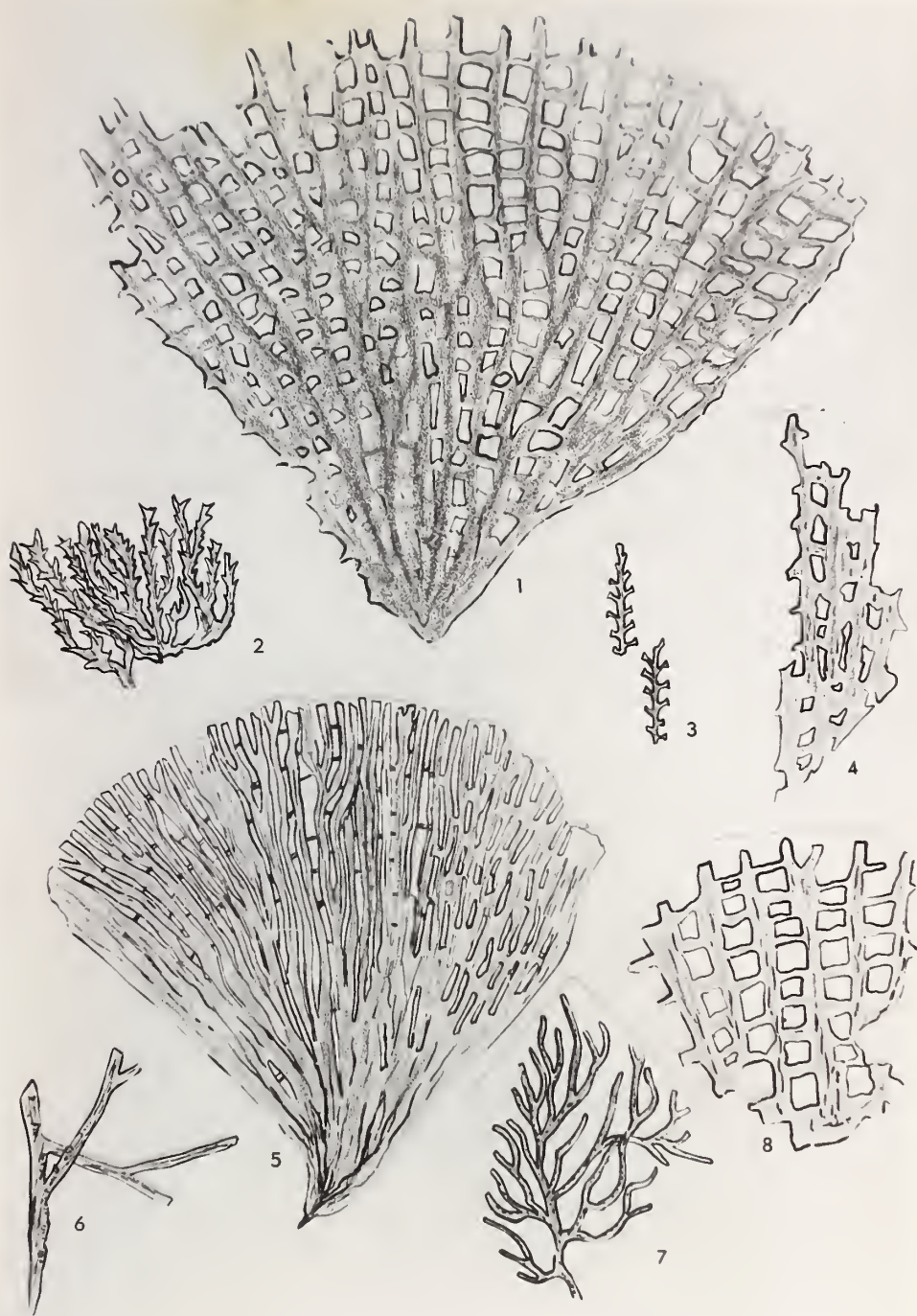


PLATE I

PLATE 2

ORDOVICIAN GRAPTOLITES OF NORTHERN YUKON

Fig.1 Callograptus salteri Hall; hypotype x 2; Lower Ordovician, "Janey" River, Yukon.

Fig.2 Dendrograptus sp., cf. D. flexuosus Hall; hypotype x 2; Lower Ordovician, "Janey" River, Yukon.

Fig.3 Callograptus staufferi Ruedemann; hypotype x 2; Lower Ordovician, Trail River, Yukon.

Fig.4 Triograptus osloensis Monsen; hypotype x 2; Lower Ordovician, Upper Canyon of Peel River, Yukon.

Fig.5,14 Staurograptus dichotomous var apertus Ruedemann; immature forms, x 2; Lower Canyon of Peel River, Yukon.

Fig.6,7 Clonograptus sp.A; 6, paratype x 2; 7, holotype x 2; Lower Ordovician, Upper Canyon of Peel River, Yukon.

Fig.8,11-13 Anisograptus richardsoni Bulman; x 2, 8,11,12 immature forms from Road River Tributary; 13, mature form from Lower Canyon of Peel River, Yukon; Lower Ordovician.

Fig.9 Clonograptus tenellus (?) (Linnason); hypotype x 2; Lower Ordovician, Upper Canyon of Peel River, Yukon.

Fig.10 Dichagraptus maccoyi Harris and Thomas; hypotype x 2.5; Lower Ordovician, Lower Canyon of Peel River, Yukon.

Fig.15 Clonograptus (?) sp.; hypotype x 2; Lower Ordovician, Lower Canyon of Peel River, Yukon.

Fig.16 Clonograptus flexilis (Hall); hypotype x 2; Lower Ordovician, Lower Canyon of Peel River, Yukon.

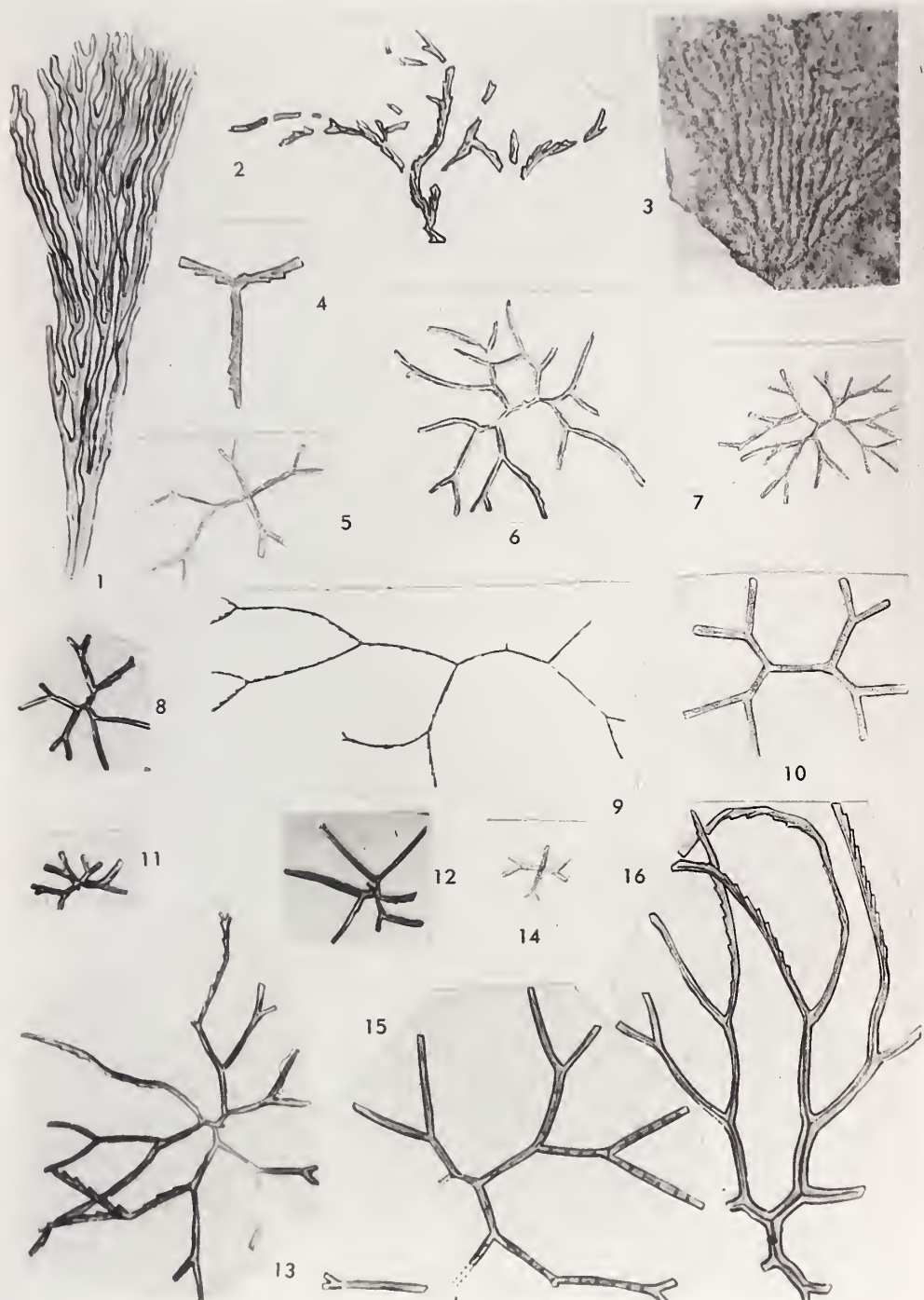


PLATE 2



PLATE 3

ORDOVICIAN GRAPTOLITES OF NORTHERN YUKON

- Fig. 1 Staurograptus (?) dichotomous var. apertus Ruedemann; hypotype x 2; Lower Ordovician, Upper Canyon of Peel River, Yukon.
- Figs. 2, 6, 11 Tetragraptus quadribrachiatus (Hall); 2, mature specimens; 11, variant form; all x 2; Lower Ordovician, Lower Canyon of Peel River, Yukon.
- Figs. 3, 5 Tetragraptus pendens Elles; 3, mature specimen x 2; 5, immature specimen x 2; Lower Ordovician, Road River Tributary, Yukon.
- Figs. 4, 12 Tetragraptus amii Lapworth; hypotypes x 2; Lower Ordovician, "Janey" River, Yukon.
- Fig. 7 Tetragraptus kindlei Ruedemann; hypotype x 2; Lower Ordovician, Road River, Yukon.
- Fig. 8 Tetragraptus lavalensis Ruedemann; variant form x 2; Lower Ordovician, Lower Canyon of Peel River.
- Figs. 9, 10 Tetragraptus approximatus (Nicholson); hypotypes x 2; Lower Ordovician, Lower Canyon of Peel River.
- Fig. 13 Didymograptus nicholsoni Lapworth; hypotype x 2; Lower Ordovician, Lower Canyon of Peel River, Yukon.
- Fig. 14 Tetragraptus putillus (?) Ruedemann; hypotype x 2; Lower Ordovician, Lower Canyon of Peel River, Yukon.
- Fig. 15. Dichograptus sp. A; holotype x 2.5; Lower Ordovician, Lower Canyon of Peel River, Yukon.
- Fig. 16. Dichograptus sp. B; holotype x 2; Lower Ordovician, Lower Canyon of Peel River, Yukon.

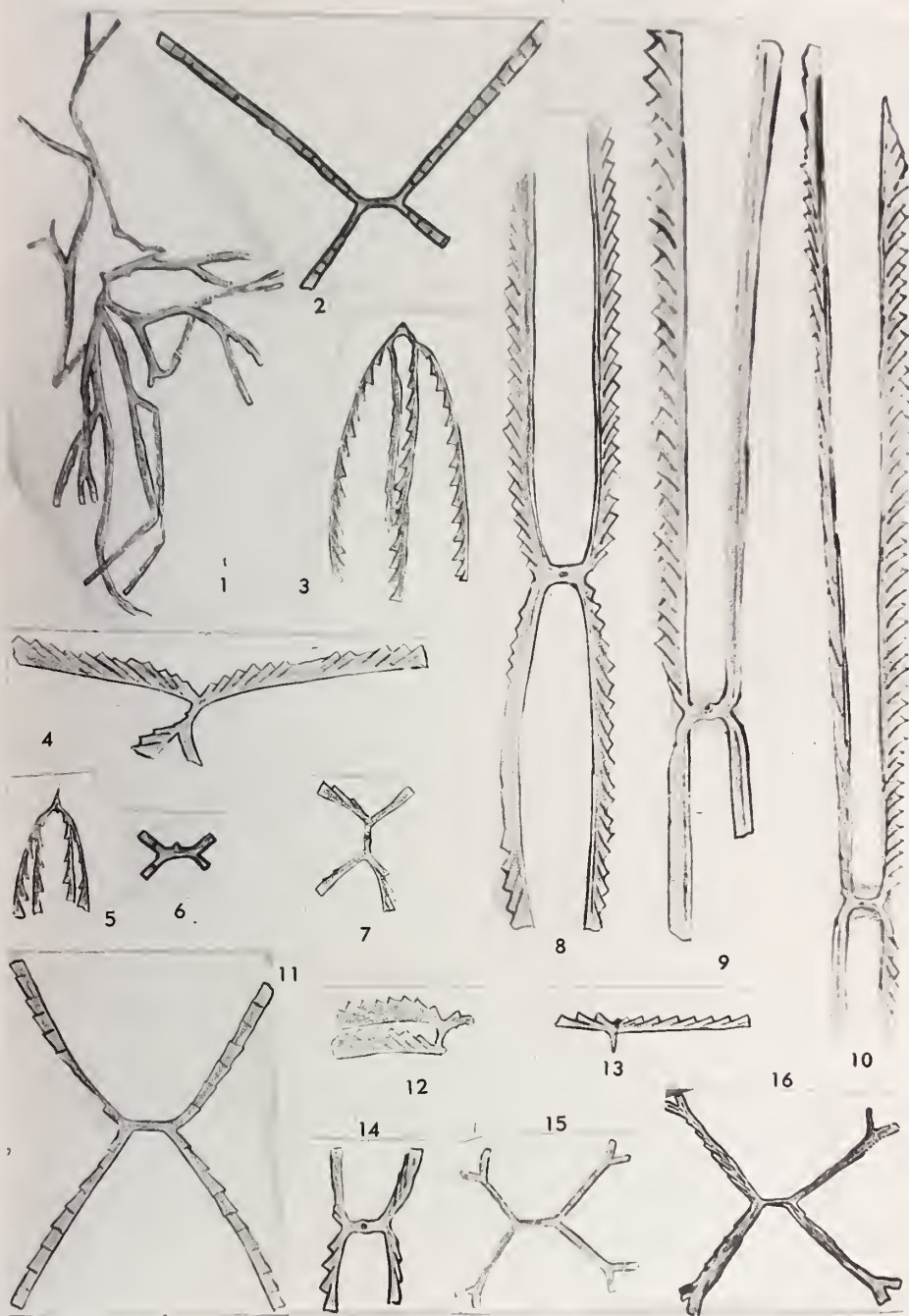


PLATE 3

PLATE 4

ORDOVICIAN GRAPTOLITES OF NORTHERN YUKON

- Fig. 1 Loganograptus logani (Hall); hypotype x 2; Lower Ordovician,
Lower Canyon of Peel River, Yukon.
- Fig. 2 Tetragraptus scandens var. curvatus Ruedemann; hypotype x 2;
Lower Ordovician, Upper Canyon of Peel River, Yukon.
- Figs. 3, 5, 6. Loganograptus logani var. pertenuis Ruedemann; hypotypes x 2;
Lower Ordovician; 3, Lower Canyon of Peel River; 5, 6,
Road River tributary, Yukon.
- Fig. 4 Tetragraptus lavalensis Ruedemann; hypotype x 2; Lower
Ordovician, Upper Canyon of Peel River, Yukon.
- Fig. 7 Dendrograptus flexuosus Hall; hypotype x 2; Lower Ordovician,
"Janey" River, Yukon.

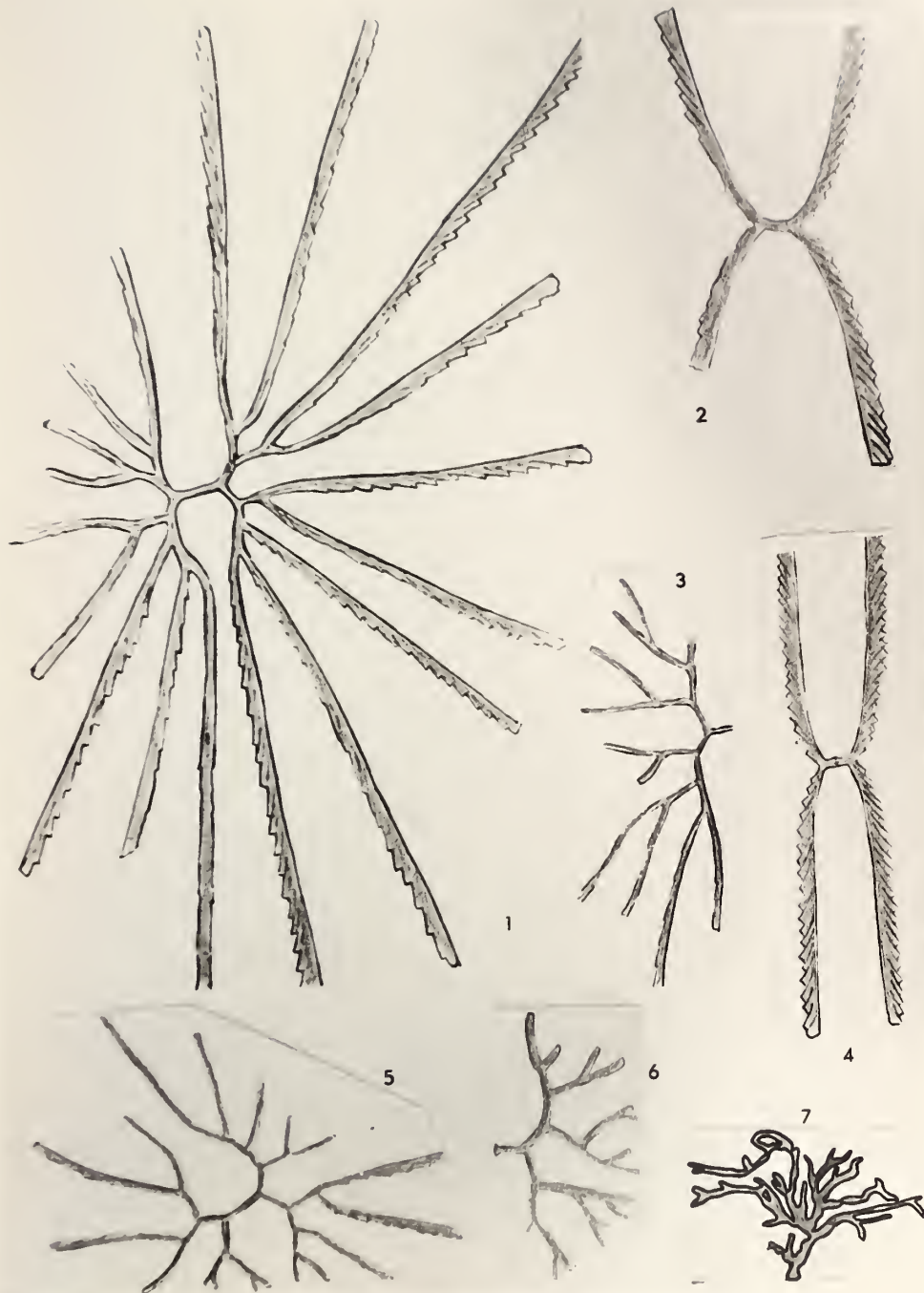


PLATE 4

ORDOVICIAN GRAPTOLITES OF NORTHERN YUKON

- Figs.1-4 Bryograptus lapworthi Ruedemann; showing growth stages x 2;
Lower Ordovician, Lower Canyon of Peel River, Yukon.
- Fig. 5 Bryograptus pusillus? Ruedemann; hypotype x 2; Lower
Ordovician, Lower Canyon of Peel River, Yukon.
- Figs.6,7 Didymograptus extensus (Hall); hypotypes x 2; Lower Ordovician
Road River, Yukon.
- Figs.8,16 Didymograptus extenuatus (Hall);8,portion of Stipe x 5
16, hypotype x 2; Lower Ordovician, Upper Canyon of Peel
River, Yukon.
- Figs.9,10 Didymograptus euodus Lapworth; 9, portion of stipe x 5;
10, hypotype x 2; Lower Ordovician, Lower Canyon of Peel
River, Yukon.
- Figs.11,12 Didymograptus nitidus(?) (Hall); 11, Sicula and portion of
stipe x 5; 12,hypotype x 2; Lower Ordovician, Upper Canyon
of Peel River, Yukon.
- Figs.13,28 Didymograptus cuspidatus Ruedemann; 13, portion of stipe x 5;
28, hypotype x 2; Lower Ordovician, Road River, Yukon.
- Fig.14 Isograptus forcipiformis (Ruedemann); hypotype x 2; Lower
Ordovician, Road River, Yukon.
- Figs.15,20 Genus novum cf. Isograptus ; 15, genotype x 2; Road River
tributary, Yukon; 20,paratype x 2, Road River, Yukon;x 2;
Lower Ordovician.
- Fig.17 Didymograptus nicholsoni Lapworth; hypotype x 1.5; Lower
Ordovician, Lower Canyon of Peel River, Yukon.

- Figs.18,27 Glossograptus horridus (?) Ruedemann; hypotypes x2; Lower Ordovician, Lower Ordovician, Lower Canyon of Peel River, Yukon.
- Figs.19,26 Isograptus caduceus (Salter); hypotypes x2; Lower Ordovician, Lower Canyon of Peel River, Yukon.
- Fig. 21 Isograptus caduceus mut. nanus (Ruedemann); hypotype x2; Lower Ordovician, Road River tributary, Yukon.
- Figs.22,25 Phyllograptus anna mut. ultimus Ruedemann; hypotypes x2; Lower Ordovician; 22,"Ede" Creek; 25, Road River tributary, Yukon.
- Figs.23,24 Isograptus caduceus var. A; 23,holotype x2; Road River tributary; 24, paratype x2,"Janey" River, Yukon; Lower Ordovician.
- Figs.29,35 Lasiograptus echinatus(Ruedemann); hypotypes x2; Lower Ordovician; 29,"Ede" Creek; 35, Lower Canyon of Peel River, Yukon.
- Fig. 30 Glossograptus ciliatus var. A; holotype x2; Lower Ordovician, Lower Canyon of Peel River, Yukon.
- Figs.31,32 Trigonograptus ensiformis (Hall); hypotypes x2; Lower Ordovician, Lower Canyon of Peel River, Yukon.
- Fig. 33 Phyllograptus sp.,cf.D. angustifolius var. magnificus Ruedemann; hypotype x2; Lower Ordovician, Road River tributary, Yukon.

- Fig. 34 Phyllograptus anna mut. longus Ruedemann;
hypotype x2; Lower Ordovician, Lower Canyon
of Peel River, Yukon.
- Fig. 36 Cryptograptus antennarius (Hall); hypotype
x2; Lower Ordovician, Road River , Yukon.
- Figs.37,38 Phyllograptus angustifolius Hall; hypotype
x2; Lower Ordovician, Road River tributary,
Yukon.

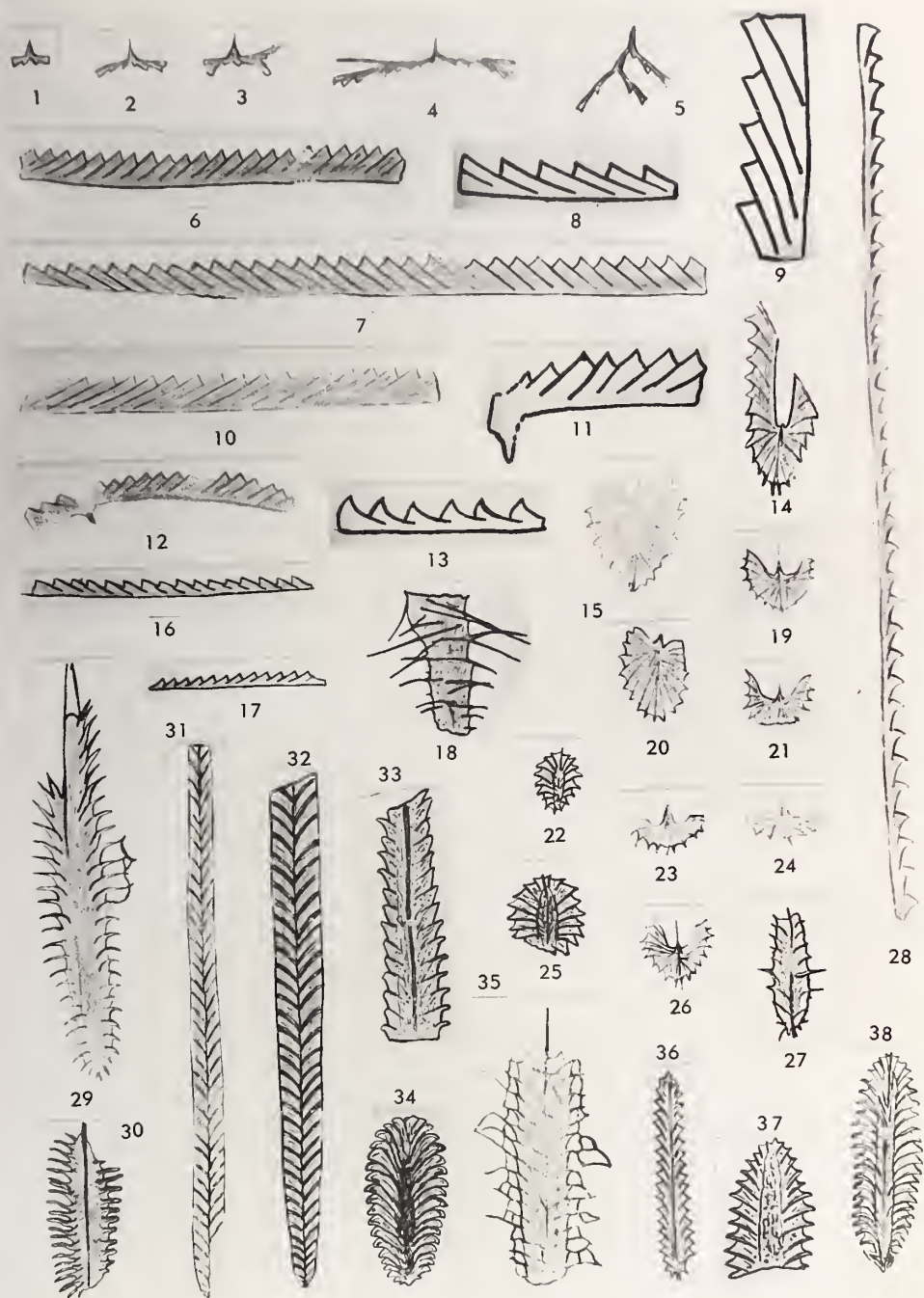


PLATE 5

ORDOVICIAN GRAPTOLITES OF NORTHERN YUKON

- Fig.1 Dicranograptus sp.,cf.D.spinifer Lapworth; hypotype x 2; Middle Ordovician, "Ede" Creek, Yukon.
- Figs.2,8,9 Climacograptus brevis Elles and Wood; 2,8, hypotypes x 2; 9, part of rhabdosome x 5; Upper Ordovician, "Ede" Creek, Yukon.
- Figs. 3,4 Diplograptus vespertinus (?) Ruedemann; 3, part of rhabdosome x 5; 4,hypotype x 2; Middle Ordovician, Upper Canyon of Peel River, Yukon.
- Figs. 5-7 Climacograptus sp.A; 5, part of rhabdosome x 2; 6 paratype x 2, Upper Canyon of Peel River, Yukon; 7, holotype x 2, "Janey" River, Yukon; Lower Ordovician.
- Figs.10,11 Climacograptus sp.,cf.C.latus Elles and Wood; 10,part of rhabdosome x 5; 11, hypotype x 2; Upper Ordovician, "Ede" Creek, Yukon.
- Figs.12,14 Diplograptus dentatus ?)(Brongniart); 12, hypotype x 2; 14,portion of rhabdosome x 5; Lower Ordovician, Upper Canyon of Peel River, Yukon.
- Fig.13 Climacograptus tridentatus var. maximus Decker; hypotype x 2; Upper Ordovician, "Janey" River, Yukon.
- Fig.15 Climacograptus bicornis (Hall); hypotype x 2, Middle Ordovician; Upper Canyon of Peel River, Yukon.
- Figs.16,17 Diplograptus sp.,cf.D.truncatus var.intermedius Elles and Wood; 16, hypotype x 2; 17,portion of rhabdosome x 2; Upper Ordovician, "Ede" Creek, Yukon.
- Figs.18,19 Diplograptus sp.,cf.D.teretisuculus var.siccatus Elles and Wood; 18,hypotype x 2; 19, portion of rhabdosome x 5; Middle Ordovician, Road River tributary, Yukon.
- Figs.20-23 Diplograptus sp.,cf.D.perexcavatus Lapworth; 20,portion of rhabdosome x 5; 21-23, hypotypes x 2; 21 with float; Lower Ordovician, Road River tributary, Yukon.

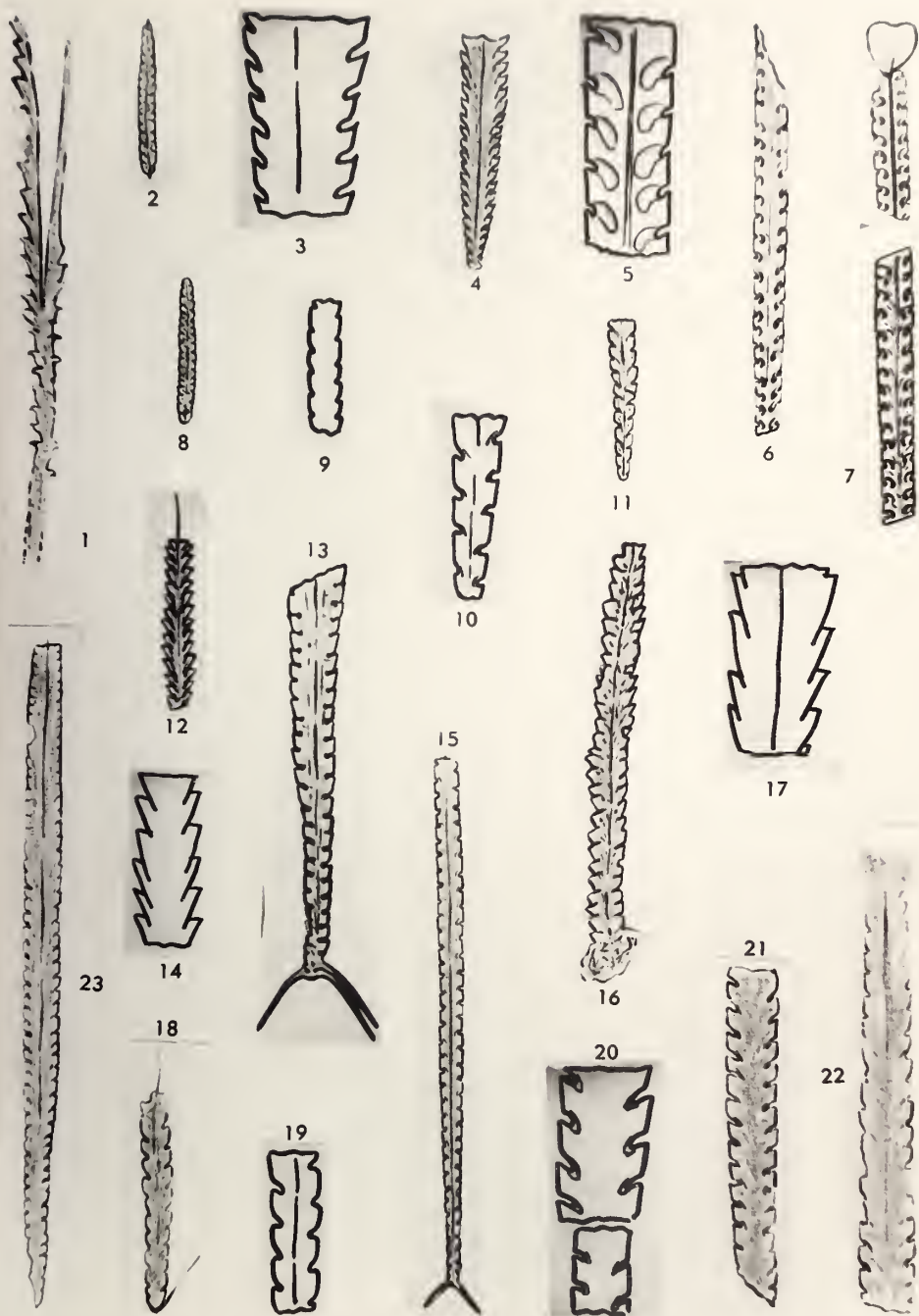


PLATE 6

SILURIAN GRAPTOLITES OF NORTHERN YUKON

- Figs.1-3 Retiolites geinitzianus Barrande;1,2, hypotypes x 2;3,part of Rhabdosome x 5; Middle Silurian,"Ede"Creek,Yukon.
- Figs.4,9 Diplograptus sp.,cf.D.tamariscus var. incertus Elles and Wood; 4, hypotype x 2; 9, portion of rhabdosome x 5; Lower Silurian, Upper Canyon of Peel River, Yukon.
- Figs.5,14 Retiolites perlatus var.daironi Lapworth; 5,portion of rhabdosome x 5; 14, hypotype x 2; Lower Silurian, Upper Canyon of Peel River, Yukon.
- Figs.6,12 Petalograptus palmeus var. tenuis? (Barrande); 6, hypotype x 2; 12, portion of rhabdosome x 5; Middle Silurian, Road River,Yukon.
- Fig.7 Monograptus communis var.A; holotype x 2; Lower Silurian Trail River, Yukon.
- Figs.8, 19 Monograptus sp.,cf.M.crinitus Wood; 8,portion of rhabdosome x 5;19, hypotype x 2; Middle Silurian, Hart River, Yukon.
- Figs.10,15 Linograptus phillipsi var. multiramosus Decker;10,hypotype x 2;15, portion of rhabdosome x 5; Middle Silurian, Hart River, Yukon.
- Figs.11 Retiolites sp.,cf.R.perlatus Nicholson; hypotype x 2; Lower Silurian, Lower Canyon of Peel River, Yukon.
- Fig.13 Cyrtograptus kindlei var.A; holotype x 2; Middle Silurian, Hart River, Yukon.
- Figs.16,22 Monograptus convolutus (Hisinger); 16, portion of rhabdosome x5; 22, hypotype x 2; Lower Silurian, Lower Canyon of Peel River, Yukon.

- Figs. 17,18 Rastrites hybridus (Lapworth); 17, hypotype x 2; 18,portion of rhabdosome x 5; Lower Silurian, Road River tributary, Yukon.
- Fig. 20 Monograptus sp.,cf.M. communis (Lapworth); hypotype x 2, Lower Silurian; Upper Canyon of Peel River, Yukon.
- Fig. 21 Monograptus convolutus var. A; holotype x 2; Middle Silurian, Road River, Yukon.

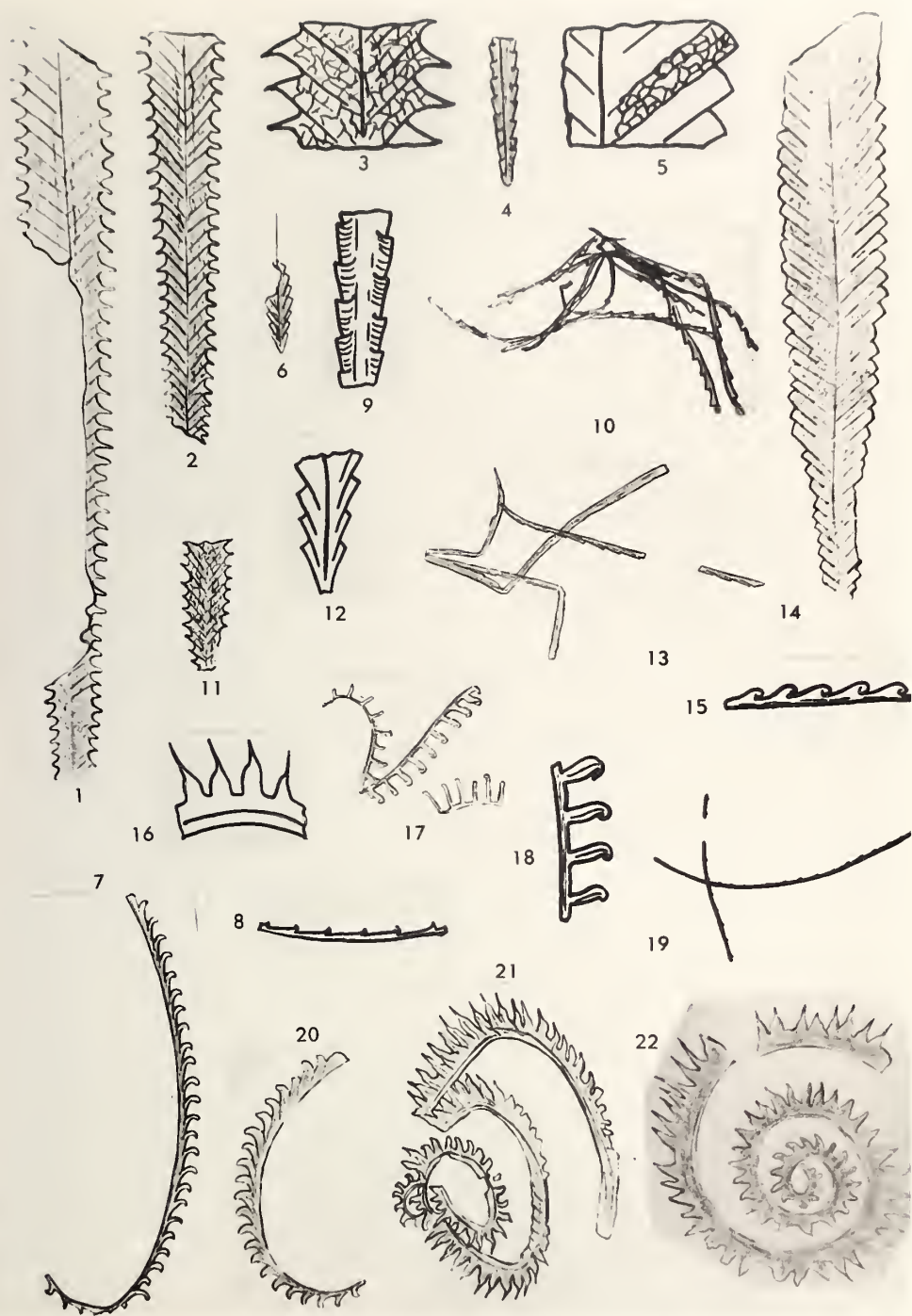


PLATE 7

PLATE 8

SILURIAN GRAPTOLITES OF NORTHERN YUKON

- Figs.1,26 Monograptus nudus (?) (Lapworth); 1, hypotype x 2; 26, portion of rhabdosome x 5; Lower Silurian, Trail River, Yukon.
- Figs. 2,10 Monograptus gemmatus (Barrande); 2, hypotype x 2; 10, portion of rhabdosome x 5; Lower Silurian, "Janey" River, Yukon.
- Figs. 3,4 Monograptus sp.,cf.M.gotlandicus Perner; 3, portion of rhabdosome x 5; 4, hypotype x 2; Middle Silurian, Hart River, Yukon.
- Figs.5,15 Monograptus sp.,cf.M.delicatulus Elles and Wood;5, portion of rhabdosome x 5; 15,hypotype x 2; Lower Silurian, Lower Canyon of Peel River, Yukon.
- Figs.6,23 Monograptus sp.,cf.M.intermedius (Carruthers); 6, portion of rhabdosome x 5; 23, hypotype x 2; Lower Silurian, Upper Canyon of Peel River, Yukon.
- Figs.7,25 Monograptus sp.cf.M.jaculum (Lapworth); 7, hypotype x 2; 25, portion of rhabdosome x 5; Lower Silurian, "Janey" River, Yukon.
- Figs.8,17 Monograptus sp.,aff.M.planus (B arrande); 8, hypotype x 2; 17,portion of rhabdosome x 5; Middle Silurian, "Ede" Creek, Yukon.
- Figs.9,12 Monograptus marri (?) Perner; 9, portion of rhabdosome x 5; 12, hypotype x 2; Middle Silurian, "Ede" Creek, Yukon.
- Figs.11,24 Monograptus riccartonensis Lapworth; 11, hypotype x 2; 24, portion of rhabdosome x 5; Middle Silurian ,Road River, Yukon.
- Figs.13,14 Monograptus exiguus (Nicholson); 13, hypotype x 2; 14, portion of rhabdosome x 5; Middle Silurian, Road River, Yukon.

- Figs. 16, 21 Monograptus nilssoni (Barrande) ; 16, portion of rhabdosome x 5, 21, hypotype x 2; Middle Silurian, Hart River, Yukon.
- Figs. 18, 20 Monograptus sp., cf. M. pandus (Lapworth) ; 18, portion of rhabdosome x 5, 20, hypotype x 2; Middle Silurian, Lower Canyon of Peel River, Yukon.
- Figs. 19, 27 Monograptus leptotheca (?) Lapworth; 19, hypotype x 2; 27, portion of rhabdosome x 2; Lower Silurian, Upper Canyon of Peel River, Yukon.
- Fig. 22 Monograptus sp., cf. M. halli (Barrande); hypotype x 2; Middle Silurian, Road River, Yukon.

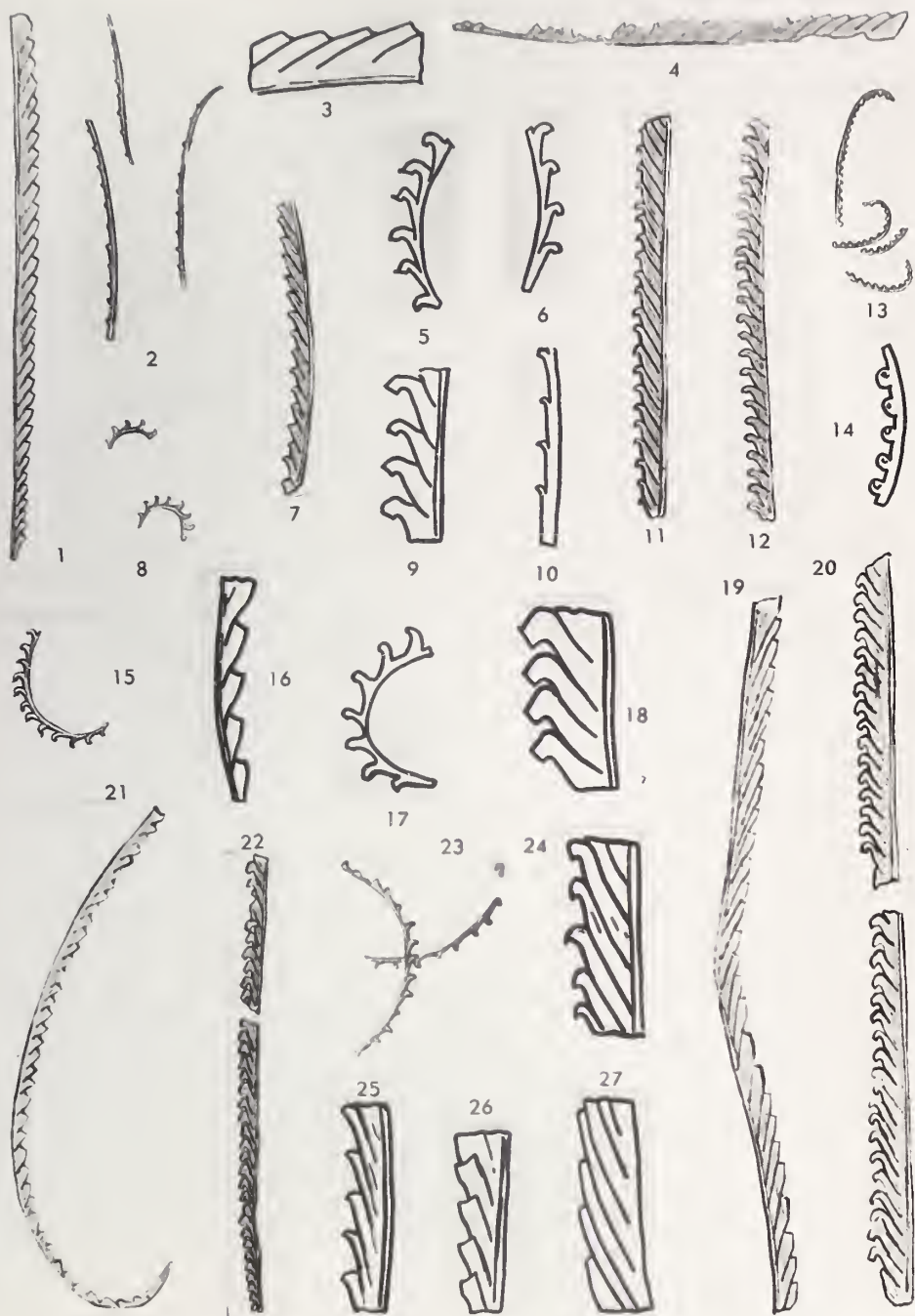


PLATE 8

PLATE 9

SILURIAN GRAPTOLITES OF NORTHERN YUKON

- Fig.1 Monograptus spiralis (Geinitz), hypotype x 2; Middle Silurian, Upper Canyon of Peel River, Yukon.
- Fig.2,13 Monograptus turriculatus (Barrande), 2, portion of rhabdosome x 5; 13, hypotype x 2; Middle Silurian, Road River, Yukon.
- Fig.3 Monograptus nilssoni (Barrande), hypotype x 2; Middle Silurian, Hart River, Yukon.
- Figs.4,16 Monograptus vomerinus (Nicholson), 4, hypotype x 2; 16, portion of rhabdosome x 5; Middle Silurian, Road River, Yukon.
- Figs.5,14 Monograptus sp., cf. M.crenularis (Lapworth), 5, hypotype x 2; 14, portion of rhabdosome x 5; Middle Silurian "Janey" River Yukon.
- Fig.6 Monograptus vomerinus var. gracilis Elles and Wood; hypotype x 2; Middle Silurian, "Ede" Creek, Yukon.
- Figs.7,10 Monograptus sp., cf. M.ultimus Perner; 7, hypotype x 2; 10, portion of rhabdosome x 5; Middle Silurian, Hart River, Yukon.
- Figs.8,11 Monograptus sp.A; 8, holotype x 2; 11, portion of rhabdosome x 5; 12, hypotype x 2; Middle Silurian, Hart River, Yukon.
- Figs.9,12 Monograptus vulgaris var curtus Wood, 9, portion of rhabdosome x 5; 12, hypotype x 2; Middle Silurian, Hart River, Yukon.
- Figs.15,17 Monograptus undulatus (?)Elles and Wood, 15, hypotype x 2 17, portion of rhabdosome x 5; Lower Silurian, "Janey" River, Yukon.

Introduction

The purpose of this document is to provide a comprehensive overview of the project's objectives and scope.

This document is organized as follows:

- 1. Introduction

- 2. Objectives and Scope

- 3. Methodology

- 4. Results and Discussion

- 5. Conclusion

- 6. References

- 7. Appendix

The following table provides a summary of the project's key findings.

The data indicates a significant increase in the number of participants over the course of the study.

The results suggest that the intervention had a positive impact on the overall health of the participants.

The study was conducted in a controlled environment, ensuring the validity of the results.

The data was collected over a period of six months, allowing for a thorough analysis of the results.

The study was approved by the relevant ethical committees, ensuring the safety and well-being of the participants.

- The study was conducted in a controlled environment, ensuring the validity of the results.

- The data indicates a significant increase in the number of participants over the course of the study.

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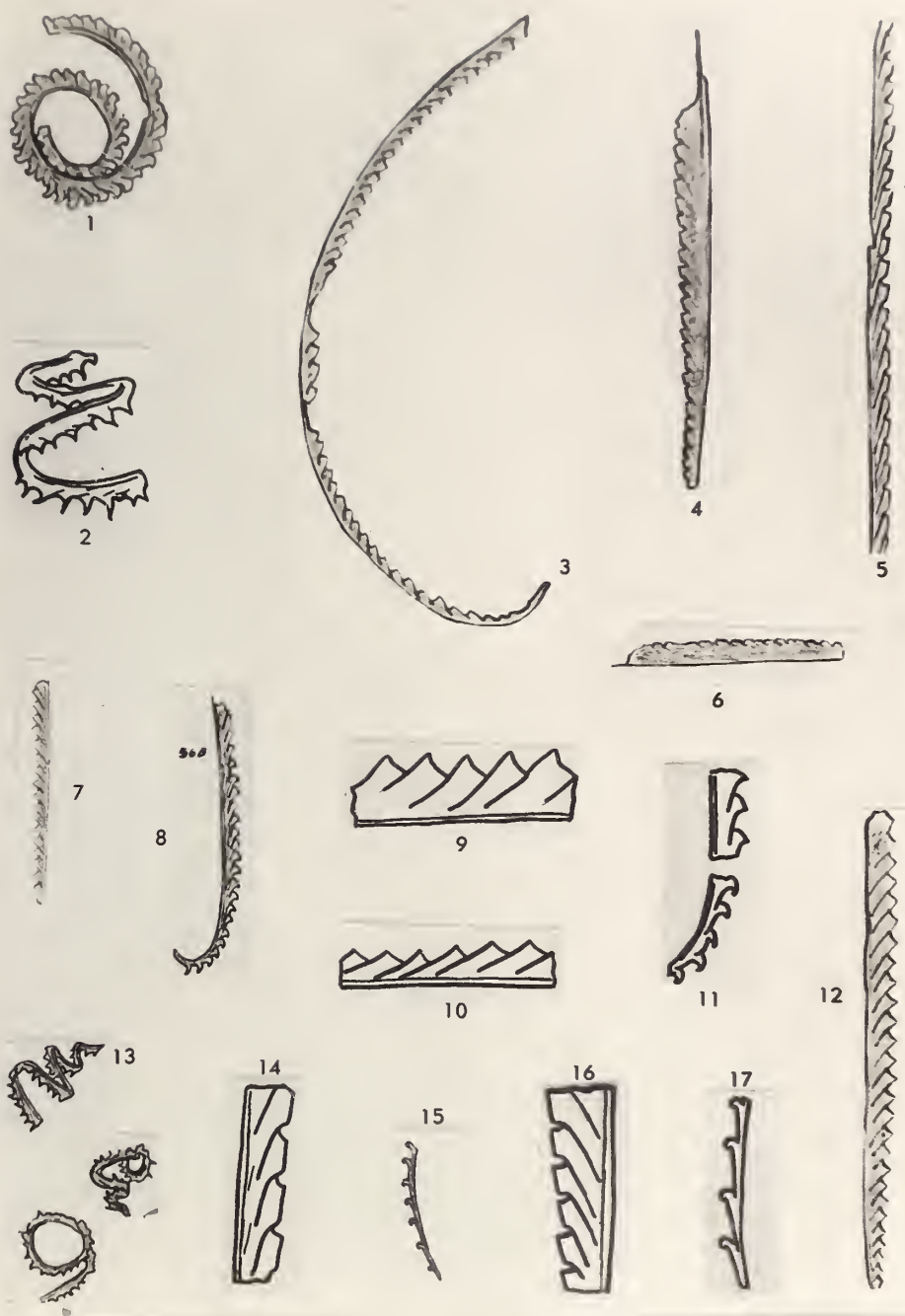


PLATE 9

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